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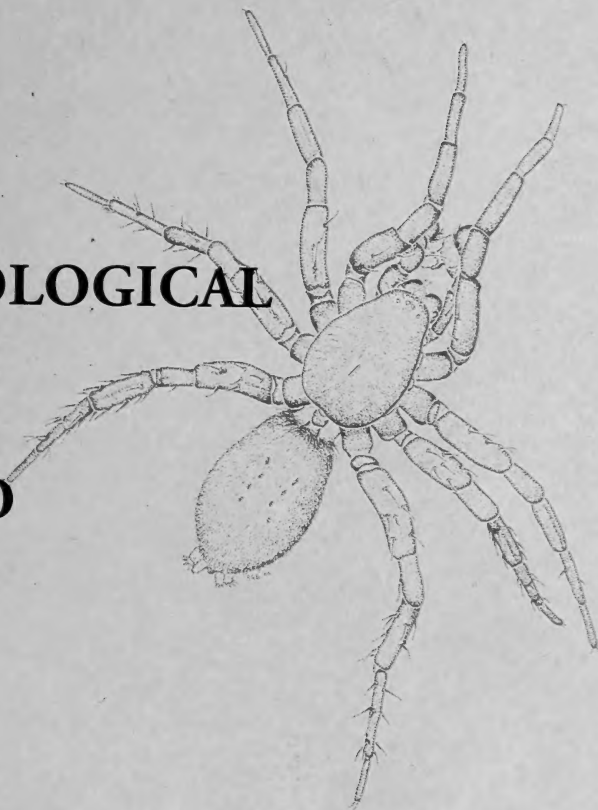
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It has been a pleasure for me to serve as Special Editor for the D. H. Pengelly tribute volumes, and to work with regular Editor Miriam Richards to line up a diverse assemblage of papers touching on the range of entomological disciplines influenced by Dave Pengelly (1922-2004). Dave was widely known, and is fondly remembered, as a fantastic teacher of entomology and as a huge contributor to the development of the University of Guelph Insect Collection; but he is also sorely missed as a seemingly infinite reservoir of entomological trivia, anecdotes, insightful stories, jokes, support, and wise advice. Almost all of the authors in these volumes were strongly influenced by Professor Pengelly, most shared his enthusiasm and passion for collecting and identifying insects, and many worked with Dave to build up the University of Guelph Insect Collection. Although now widely appreciated as a treasure trove of information about faunal change and insect distribution while also serving as the foundation for a growing body of taxonomic research, the University of Guelph Insect Collection during Pengelly's tenure was a beleaguered resource used mostly as a source of specimens for a myriad of entomology courses including the hands-on third year entomology labs that Dave taught every weekday. It is a testimonial to his foresight that he not only kept the collection from deterioration or destruction due to invasions of dermestid beetles and indiscriminate colleagues, he consistently built up the collection and increased its curatorial level annually. He did not do this alone, of course. Professor Pengelly had a contagious vision of what was needed to improve our understanding of Ontario's insects, and his enthusiasm for the study of insect biology and diversity was such that he was always associated with dedicated students. Thousands of specimen labels in the insect collection bear the names of most of the authors of papers in these volumes, standing as permanent testimonials to a shared vision that started with students working with their mentor at University of Guelph, and which continues through the widely dispersed teaching, research, and publications by Dave's students and colleagues today. I think he would have liked these sets of papers, and he would have been pleased to see them published in the journal that he supported so selflessly ... almost every copy of this journal sent out during the 16 year period "D.H." was Secretary-Treasurer of the ESO was sent out by Dave personally. We all wish he were still here to send this one out!

Steve Marshall  
Special Editor



## **IN MEMORIAM: DAVID HARVEY PENGELLY**

March 22, 1922 - October 31, 2004

The ancient Roman Naturalist Lucretius said: "No single thing abides but all must flow, Fragment to fragment clings, the things thus grow, Until we know and name them and by degrees they melt and are no more the things we know".

Knowing and naming insects was Dave's life-long passion. This passion was manifest in his commitment to The Entomological Society of Ontario, to the science of Entomology, and to his teaching.

Dave's life of research and teaching involved his own take on the natural history of insects. His beginnings were with the megachilids, camping with Fran and their two young boys in the Bruce Peninsula among the Black Widow Spiders and Massassauga rattlers which are now much less abundant.

Dave was Secretary Treasurer of the Society for as long as present members can remember. With his appointment, he became the curator of the university insect collection, which had its origins with the Entomological Society in the nineteenth century. He fathered the growth, preservation, housing, and display of one of the largest insect collections in Canadian universities. Few really knew what he accomplished unassisted.

First and foremost for Dave was his teaching of Systematics and the Natural History of Insects. He had the heaviest teaching load in the department. His efforts and teaching abilities were recognized when he received the Outstanding Teacher Award. All his students held him in high regard and affection.

Dave had a great sense of humor and was a great storyteller. Through the many stories he told, the origins and inspiration for Dave's success as a teacher could be traced. De-mobbed from the air force, Dave became an undergraduate at the University of Alberta. Here Dave was immediately attracted to the great teacher and mentor, Professor E. Harold Strickland, himself a WW1 veteran who was the sole entomologist and head of department for many years.

In remembering David Pengelly, we each relive the very best of university traditions ... the tradition of one generation inspiring and mentoring the next as companions in this great enterprise. This memorial issue of the journal is an eloquent example of this tradition.

Stuart E. Dixon

IN MEMORIAM: DAVID HARVEY PENCILLY

**ECTOPARASITES (PHTHIRAPTERA: PHILOPTERIDAE; ACARI: IXODIDAE) OF COMMON NIGHTHAWK, *CHORDEILES MINOR*, AND WHIP-POOR-WILL, *CAPRIMULGUS VOCIFERUS* (CAPRIMULGIFORMES: CAPRIMULGIDAE), IN MANITOBA**

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**Abstract**

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Samples of 103 salvaged Common Nighthawks (*Chordeiles minor* (Forster)) and seven Whip-poor-wills (*Caprimulgus vociferous* Wilson) were examined for ectoparasites in Manitoba during 1992-2004. Two nighthawks were infested with the rabbit tick, *Haemaphysalis leporispalustris* (Packard), and 64 (62.1%) with the chewing louse, *Mulcticola macrocephalus* (Kellogg), at a mean intensity of 13.5. Louse infestation fits a negative binomial distribution ( $k=0.299$ ; mean/variance ratio=18.5); females outnumbered males in the total sample, males:females=0.66. Prevalence of infestation was lower in adult birds examined during May and June (37.5%;  $n=16$ ) than in mixed-age birds examined from 31 July to December (64.7%;  $n=85$ ), though mean intensity was similar (17.7 versus 13.6, respectively). Two of seven Whip-poor-wills were infested with an undescribed *Mulcticola* sp.

*Published July 2007*

**Introduction**

Many people are familiar with the two species of goatsuckers (Caprimulgiformes: Caprimulgidae) found in Manitoba. Common Nighthawks, *Chordeiles minor* (Forster), are usually seen flying erratically high overhead in their search for aerial prey, particularly at dusk on warm summer evenings. Their distinctive call and white patches on the undersides of their wings make them readily identifiable, and they are unlikely to be confused with any other species. The Whip-poor-will, *Caprimulgus vociferus* Wilson, makes the familiar, "Whip-poor-will! Whip-poor-will! Whip-poor-will!" call that has kept many a camper awake into the wee hours of the morning. As familiar as these birds may be, few people have seen them up close. Both are secretive during the day and well camouflaged so that detection is difficult. The greatest chance of seeing a nighthawk on the ground might be when an injured bird is found, although occasionally they rest in the open (Taylor and Holland 2003). Despite their abundance in North America, details of the biology of the Common Nighthawk and the Whip-poor-will are poorly known (Poulin et al. 1996; Cink 2002).

Apart from the original description of the chewing louse, *Mulcticola macrocephalus* (Kellogg) (Phthiraptera: Philopteridae), there is very little known about ectoparasites of the Common Nighthawk and Whip-poor-will in North America. During a survey of the ectoparasites associated with birds in Manitoba, I had the opportunity to examine a relatively large sample of nighthawks and a small number of Whip-poor-wills. Given our poor knowledge of parasites associated with these species, and that there is evidence that bird populations may be in decline in many areas (Wedgewood 1992; Poulin et al. 1996; Taylor 1996; Cinc 2002), a close examination of data collected from the survey was warranted.

Undergraduate entomology majors at the University of Guelph back in the early 1970's had a great deal of contact with Dave Pengelly. His Natural History of Insects course was often the one to ignite the passion for insects so characteristic of the time, and his courses in Insect Taxonomy and Aquatic Entomology required collections of insects that became the obsessions of so many of us. He was always around and always encouraging to the students struggling with their collections or with their thoughts on insects. Dave always seemed interested in what insects were where and what it was they did. Many times, he mentioned to me that there were few people working on lice, and that someone should do something about them in Canada. For that reason, I like to think he would have enjoyed reading this paper, and I dedicate it to his memory, with many thanks for his continued support and friendship over the years.

## Methods

Birds were salvaged from a number of sources, primarily from the Manitoba Wildlife Rehabilitation Organization's hospital (MWRO) at the Glenlea Research Station (Faculty of Agricultural and Food Sciences), and from Manitoba Conservation's office in Winnipeg under a scientific collecting permit issued by the Canadian Wildlife Service. A few birds were found dead by members of the public. No attempt was made to sex or age the birds. Each bird was individually bagged immediately after death and frozen to kill all ectoparasites. Ectoparasites were collected from two nighthawks examined early in the survey (1992-1993) by ruffling the feathers of each over a white enamel pan. Subsequently examined birds were washed in warm, soapy water and ectoparasites were collected using methods described in Mironov and Galloway (2002). Ectoparasites were preserved in 70% ethanol, and slides of representative specimens of chewing lice were made throughout the study using the method described by Richards (1964). Terminology of Margolis et al. (1982) is adopted here for infestation parameters; prevalence (percentage of hosts infested) and mean intensity (mean number of lice per infested host) are reported for parasitism by *M. macrocephalus*.

Calculations and comparisons of infestation parameters were conducted using Quantitative Parasitology 2.0, according to Rózsa et al. (2000). Voucher specimens are deposited in the J. B. Wallis Museum of Entomology (Department of Entomology, University of Manitoba, Winnipeg, Manitoba R3T 2N2) and in the Canadian National Collection (Agriculture and Agri-Food Canada, Ottawa, Ontario K1A 0C6).

## Results

### Common Nighthawk

During the period of this survey, 1992-2004, 103 nighthawks were examined from 25 known localities in Manitoba. Numbers of birds examined each year of the survey were as follows: 1992-1, 1993-1, 1994-4, 1995-17, 1996-3, 1997-12, 1998-4, 1999-17, 2000-7, 2001-12, 2002-4, 2003-6, 2004-14, plus one bird with no known collection year. Most birds ( $n=65$ ) were found in Winnipeg, additionally with four from Glenlea, two each from Headingley, Niverville, and Selkirk, and one bird each from the following localities: Tooth Lake, Lockport, Stony Mountain, Camp Shilo, Portage la Prairie, St. Laurent, Dauphin, Clandeboye, Great Falls, Cartier, Grosse Isle, Sanford, Morris, Richot, Beausejour, Roblin, Morden, West St. Paul, Moosehorn, and Îles des Chênes. There were no associated locality data for eight birds, though these birds were found in Manitoba. Relatively few birds were collected during spring migration or during the breeding season ( $n=16$ ) when only adult birds would be expected: May-2; June-14. Most birds were submitted during the latter part of the season, during the period of return migration ( $n=85$ ), when a mixture of adults and young of the year would be included in the samples: July-1 (this bird died on 31 July); August-53, September-29, November-1, December-1. Two birds had no reliable dates of collection.

Diversity of ectoparasites was relatively low. Two nighthawks were each infested with one rabbit tick nymph, *Haemaphysalis leporispalustris* (Packard), one from Winnipeg, 26 July 1999, and the other from Moosehorn, 5 September 2004. The only insect ectoparasites collected were the chewing lice, *M. macrocephalus*, a specific parasite of Common Nighthawk (Price et al. 2003), and *Columbicola columbae* (Linnaeus). Only one bird was infested with *C. columbae* (1♂; 1♀), which is a parasite of Rock Pigeon, *Columba livia* Gmelin; this infestation is likely a contamination and is not considered further.

In the total sample of birds, 62.1% ( $n=64$ ) were infested with *M. macrocephalus* (95% exact confidence limits: 51.1%-70.6%) and the mean intensity of infestation was 13.5 (95% bootstrap confidence limits: 10.72-16.89). The most heavily infested bird carried 60 lice, and 19 birds (18.5%) carried more than 20 lice. The infestation of lice among all hosts fits a negative binomial distribution ( $k=0.299$ ,  $P\leq 0.05$ ; variance/mean ratio=18.5), and the Index of Discrepancy (D) was 0.693. Median intensity of infestation was 8.0.

The male:female sex ratio was 0.66. Of 874 *M. macrocephalus* collected over the entire study, 191 (21.9%) were males, 272 (31.1%) were females, and 411 (47.0%) were nymphs. The sex ratio for lice collected during May and June was 0.28, largely the result of disproportionate numbers of females on two birds (one with 19 females and no males, the other with 21 females and 3 males). For lice collected from mixed-age birds during July to August, the sex ratio was 0.80. The proportion of nymphs collected during these corresponding time periods were not substantially different, 43.9% versus 47.8%. Among the 14 birds that were infested with at least one female louse but no males, 6 were accompanied by at least one nymph, and there were no nymphs found on 8 birds. Only 4 birds were infested with males but no females, 2 of which had no nymphs. Three infested birds had 1, 2, and 5 nymphs, but no adult lice.

Among the 16 adult birds examined during May and June, only 6 (37.5%; exact confidence limits=15.2%-64.6%) were infested, with a mean intensity of 17.8 (95% bootstrap

confidence limits: 6.33-30.83). Prevalence was significantly higher ( $\chi^2=4.167$ ;  $P=0.041$ ) among the mixed age birds examined during July to December, when prevalence was 64.7% (exact confidence limits=53.6%-74.8%). There was no significant difference (bootstrap  $P=0.56$ ) in mean intensity of mixed-age (13.6; bootstrap confidence limits=10.51-17.44) compared to adult birds collected during May and June.

### Whip-poor-will

Only seven Whip-poor-wills were examined over the survey period: four from Winnipeg, one each from Portage la Prairie and Grunthal, and one from Manitoba, but with no specific locality data. Three birds were examined in 1995 and one each in 1996, 1997, 2001, and 2003. None of the birds were sexed or aged, but four were submitted in May to early July, and would likely have been adults. Two birds (Portage la Prairie, 1 July 1995–2 nymphs; Winnipeg, 30 August 2001–1♂; 1♀) were infested with an undescribed *Mulcticola* sp. Too few specimens are available for a formal description of this new species.

## Discussion

As Dave Pengelly so often told me, “It’s surprising what you find if you take the time to look.” This study has been a perfect example. There are no published records of ectoparasites of the Common Nighthawk (other than a record of *Pseudolychnia brunnea* (Latreille) (Hippoboscidae) in Ontario (Bequaert 1955; Wheeler and Threlfall 1989)) or the Whip-poor-will in Canada, and there is only one report of an unidentified louse on approximately 2% of Whip-poor-wills examined in Kansas (Cine 2002). Although the rabbit tick, *Ix. leporispalustris*, commonly infests a variety of ground dwelling birds in Manitoba (Kgoroba 1986), I know of no records for this tick infesting *Chordeiles minor*.

Whip-poor-wills are very seldom submitted to the MWRO and are not particularly common in cities or towns. As a result, there are few data available on their ectoparasites. I can only offer encouragement to others who may be in a position to examine this species, in the chance that additional specimens of the *Mulcticola* sp. might be collected. That two of seven birds examined in Manitoba were infested with lice is clear indication that further searches will be productive.

*Chordeiles minor* on the other hand, is a commonly seen bird even in cities where they frequently nest on roofs of suitable buildings. They are abundant where people live and where people are likely to find disabled birds to submit to a wildlife hospital facility. This is clearly indicated by the overwhelming proportion of the birds examined in this study which came from Winnipeg (68% of the birds from known localities). Galloway (2005) discussed some of the advantages and disadvantages of relying on salvaged birds for the study of their parasites, and the efficacy of the method of collecting lice from salvaged birds is certainly acceptable (Clayton and Drown 2001). However, in the present study, there are a number of factors to keep in mind while interpreting infestation parameters. The data reported here were pooled from birds salvaged over a thirteen year span, with one to 17 birds examined in any given year, and mostly from the five month period of spring to fall migration. Although most of the birds were found in Winnipeg, the remainder ( $n=30$ ) were from other locations, or from no known location ( $n=8$ ). Clearly, any conclusions drawn

from this dataset may only be indicative, and additional information from more intensive and controlled sampling is desirable. Having said this, given the nature of the host, this may be difficult to accomplish, and therefore it is useful to make some cautious observations from the data at hand.

Common Nighthawks are relatively long-lived birds, the life span generally being four to five years, but birds have been recorded to live up to nine years (Dexter 1961). They are largely solitary, though they do migrate in fall in large flocks through Manitoba (Taylor and Holland 2003). Opportunities for exchange of lice during this period or on the wintering grounds are unknown, but lice can certainly be transferred during mating and from parents to offspring; males are known to roost together (Poulin et al. 1996) and lice may disperse from one host to another at this time as well. Nothing is known about the longevity of *M. macrocephalus*. All of these factors could lead to the relatively high prevalence of infestation (61.2%) observed, in addition to the possibility that birds which are submitted to a wildlife rehabilitation facility may inherently be more heavily infested as a result of their injuries or disabled condition.

*Mulcticola macrocephalus* infestations on Common Nighthawk conformed to a negative binomial distribution. This is not particularly unusual, and this level of aggregation has been demonstrated in infestations of many species of lice on birds (e.g., Eveleigh and Threlfall 1976; Rózsa et al. 1996). The more interesting manifestation was in its prevalence. The sample of infested adult birds during May and June was admittedly small (6 of 14), but among these birds, there was a substantial proportion of the *M. macrocephalus* population made up of juveniles, about 44%, not substantially different from that found on the mixed-age birds sampled later in the season (about 48%). From this, it is reasonable to conclude that the lice are actively reproducing at the time the birds return to the breeding ground. However, the proportion of males relative to females on those adult birds (0.28) was lower than on mixed-age birds (0.80), though females usually outnumbered males (in 37 of 63 infested birds), sometimes considerably. Without knowing something about factors affecting mortality in males versus females, or relative longevity in each sex, it is difficult to speculate on the reasons for this skewed sex ratio, though it has been suggested that by the very nature of louse populations on solitary birds, a bias for females should be favoured (Clayton et al. 1992; Rózsa et al. 1996). Among these same adult birds in which numbers of males were low, prevalence of infestation was also significantly lower than among mixed age birds sampled later in the year (37.5% versus 64.7%). Perhaps the opportunities to acquire additional lice during the non-breeding season are not particularly great, and some birds infested with few lice may lose their infestation. Nearly one third of the infested birds (31.8%) had five or fewer lice, and many of these had either just one louse ( $n=7$ ), or adult lice of only one sex ( $n=3$ ). Among these latter birds, in the presumed absence of parthenogenesis in *M. macrocephalus*, and unless single adult females were already mated, it would seem that these populations of lice have a high probability of extirpation, in the absence of recruitment from some other infested host. During the non-breeding season, it is likely that opportunities for reinfestation or supplementation of a small population of lice are not great, and as a consequence, prevalence of infestation in birds returning to the breeding ground may be at its lowest of the year.

Populations of Common Nighthawk are reported to be in decline (Poulin et al. 1996; Murphy 2003). A number of researchers have drawn attention to conservation issues related

to ectoparasites (Rósza 1992; Stork and Lyal 1993; Windsor 1995; Whiteman and Parker 2005). However, despite being monoxenous, it is unlikely that the continued occurrence of *M. macrocephalus* is threatened, given its high prevalence on Common Nighthawk, unless there is a precipitous decline in host populations. There are insufficient data from surveys of Whip-poor-will to provide a clear indication of trends in their populations (Cink 2002); it is not possible to speculate on the status of *Multicicola* sp.

The most obvious benefit of the opportunity to examine salvaged birds is to gain access to samples, sometimes quite large, of host species that are otherwise difficult or impossible to sample intensively. From this, we gain an appreciation of the diversity of the fauna of ectoparasites to be found. This also allows some insight into the nature of the interaction and biogeographic relationship between these ectoparasites and their hosts.

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## References

- Bequaert, J. C. 1955. The Hippoboscidae or louse-flies (Diptera) of mammals and birds. Part II. Taxonomy, evolution and revision of American genera and species. *Entomologica Americana* 35: 233-416.
- Clayton, D. H. and D. M. Drown. 2001. Critical evaluation of five methods for quantifying chewing lice (Insecta: Phthiraptera). *Journal of Parasitology* 87: 1291-1300.
- Clayton, D. H., R. D. Gregory, and R. D. Price. 1992. Comparative ecology of Neotropical bird lice (Insecta: Phthiraptera). *Journal of Animal Ecology* 61: 781-795.
- Cink, C. L. 2002. Whip-poor-will (*Caprimulgus vociferus*). In *The Birds of North America*, No. 620. A. Poole and F. Gill (eds.), The Birds of North America, Inc., Philadelphia, PA.
- Dexter, R. W. 1961. Further banding and nesting studies of the Common Nighthawk. *Bird-Banding* 32: 79-85.
- Eveleigh, E. S. and W. Threlfall. 1976. Populations dynamics of lice (Mallophaga) on auks (Alcidae) from Newfoundland. *Canadian Journal of Zoology* 54: 1694-1711.
- Galloway, T. D. 2005. Ectoparasites from native and introduced birds from Christchurch and surrounding areas, New Zealand. *Tuhinga – Records of the Museum of New*

Zealand Te Papa Tongarewa 16: 13-20.

- Kgoroba, K. G. 1980. A study of the seasonal population dynamics of the ticks *Dermacentor variabilis* (Say) and *Haemaphysalis leporispalustris* (Packard). M.Sc. thesis, University of Manitoba, Winnipeg, Manitoba, Canada. 203 pp.
- Margolis, L., G. W. Esch, J. C. Holmes, A. M. Kuris, and G. A. Schad. 1982. The use of ecological terms in parasitology. *Journal of Parasitology* 68: 131-133.
- Mironov, S. V. and T. D. Galloway. 2002. Four new species of feather mites (Acari: Analgoidea). *The Canadian Entomologist* 134: 605-618.
- Murphy, M. T. 2003. Avian population trends within the evolving agricultural landscape of eastern and central United States. *The Auk* 120: 20-34.
- Poulin, R. G., S. D. Grindal, and R. M. Brigham. 1996. Common Nighthawk (*Chordeiles minor*). In *The Birds of North America*, No. 213. A. Poole and F. Gill (eds.). The Academy of Natural Sciences, Philadelphia and the American Ornithologists' Union, Washington, D.C.
- Price, R. D., R. A. Hellensthal, R. L. Palma, K. P. Johnson, and D. H. Clayton. 2003. The chewing lice: world checklist and biological overview. Illinois Natural History Survey Special Publication 24. x + 501 pp.
- Richards, W. R. 1964. A short method for making balsam mounts of aphids and scale insects. *The Canadian Entomologist* 96: 963-966.
- Rózsa, L. 1992. Points in question: endangered parasite species. *International Journal of Parasitology* 22: 265-266.
- Rózsa, L., J. Reiczigel, and G. Majoros. 2000. Quantifying parasites in samples of hosts. *Journal of Parasitology* 86: 228-232.
- Rózsa, L., J. Rékasi, and J. Reiczigel. 1996. Relationship of host coloniality to the population ecology of avian lice (Insecta: Phthiraptera). *Journal of Animal Ecology* 65: 242-248.
- Stork, N. E. and C. H. C. Lyal. 1993. Extinction or 'co-extinction' rates? *Nature* 366: 307.
- Taylor, P. 1996. Apparent decline of migrant Common Nighthawks near Pinawa, Manitoba. *Blue Jay* 54: 35-38.
- Taylor, P. and G. E. Holland. 2003. Whip-poor-will. In *The Birds of Manitoba*, Manitoba Naturalists' Society, Friesens Printers. p. 239.
- Wedgewood, J. 1992. Common Nighthawks in Saskatoon. *Blue Jay* 50: 211-217.
- Wheeler, T. A. and W. Threlfall. 1989. Synopsis of parasites of vertebrates of Canada. Ectoparasites of birds. Alberta Agriculture. v + 85 pp.
- Whiteman, N. K. and P. G. Parker. 2005. Using parasites to infer host population history: a new rationale for parasite conservation. *Animal Conservation* 8: 1-7.
- Windsor, D. A. 1995. Equal rights for parasites. *Conservation Biology* 9: 1-2.

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# REDESCRIPTION OF THE RARE GROUND SPIDER *GNAPHOSA SNOHOMISH* (ARANEAE: GNAPHOSIDAE), AN APPARENT BOG SPECIALIST ENDEMIC TO THE PUGET SOUND / GEORGIA BASIN AREA

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## Abstract

*J. ent. Soc. Ont.* 137: 13-23

Existing descriptions and illustrations do not allow easy identification of the gnaphosid ground spider *Gnaphosa snohomish* Platnick and Shadab (Araneae: Gnaphosidae). It is apparently a truly rare, bog-associated species endemic to the Puget Sound / Georgia Basin area. The species is redescribed and illustrated from a significant series of mature males and females collected in an abandoned cranberry bog in Burnaby, British Columbia. An existing key to *Gnaphosa* species is revised to incorporate newly identified diagnostic characters. Few other museum specimens of *G. snohomish* exist and the Burnaby population is the only substantial population known. However, that population may no longer exist as the site has been redeveloped as a commercial cranberry bog and apparently little suitable habitat for this species now exists in the area.

*Published July 2007*

## Introduction

The gnaphosid ground spiders are a relatively well known group largely because Norman Platnick and colleagues (references in Platnick 2006) have published over 60 papers on gnaphosid taxonomy and systematics. With 1,975 species recognized in 116 genera (Platnick 2006), Gnaphosidae forms the seventh largest of the 111 currently accepted families within Araneae. The Holarctic genus *Gnaphosa* Latreille accounts for 135, or roughly 7% of these species. Most are Palearctic in distribution; only 20 species occur in the Nearctic region (Ubick 2005).

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Except for a small minority of species, most of the Nearctic *Gnaphosa* are relatively widespread, fairly common species and specimens are often abundant in open or partially open habitats. Pitfall-collected samples from such habitats may produce significant numbers of *Gnaphosa* specimens (e.g. Bennett and Salomon unpublished data; Dondale and Redner 1994; Troubridge et al. 1998). Most notable among the uncommon species of *Gnaphosa* is *G. snohomish* Platnick and Shadab (Fig. 1) which was described on the basis of a single specimen of each sex; no other verified specimens were known to us prior to the work of Troubridge et al. (1998). This species appears to be a truly rare, bog specialist endemic to a small area of the Puget Sound / Georgia Basin area of northwestern Washington State and southwestern British Columbia.

In 1998, as part of an arthropod study in cranberry bogs, two of us (JT and SF) initiated a pitfall trapping program in a former commercial bog (49°11'43"N, 122°58'35"W) in Burnaby, BC that had been abandoned for at least 15 years. The site, part of an area known locally as the "Marshlands," is located on the north shore of the north arm of the Fraser River adjacent to the southwest corner of the intersection of Marine Drive and North Fraser Way. The Marshlands area, originally an extensive peat (*Sphagnum fimbriatum* Wils. in Wils. and Hook. (Sphagnidae)) bog, was heavily developed for agricultural purposes during the 20<sup>th</sup> century.

Traps at the site were checked weekly from mid May until early September. Among the spider specimens collected were 211 gnaphosids unidentifiable by us beyond "*Gnaphosa* sp." Given that the Nearctic *Gnaphosa* species are well known (and that the spider fauna of the Puget Sound / Georgia Basin area has been reasonably well sampled), we considered it odd that we could not place these specimens. They seemed closest to *G. snohomish* and *G. antipola* Chamberlin but we could not reliably assign the specimens to either species.

We sent a sample of males and females of the unidentified *Gnaphosa* species to the American Museum of Natural History for identification by N. Platnick. He determined that the spiders were specimens of *G. snohomish* and furthermore that the published descriptions and illustrations (Platnick and Shadab 1975; Platnick and Dondale 1992) of the single known specimen of each sex were flawed in ways that became apparent only through the examination of our specimen series (Platnick pers. comm.).

Accurate identification of *G. snohomish* specimens is difficult using existing taxonomic literature. It is important that specimens be easily identified because this spider may be a good candidate for protection under federal endangered species legislation in both Canada and the United States. For these reasons a redescription of the species (including modifications to two couplets in the key to *Gnaphosa* species published in Platnick and Dondale (1992)) and a discussion of its apparently obligate association with peatlands in the Georgia Basin and Puget Sound area are presented here.

## Methods

This work is based upon examination of 103 males, 49 females, and 59 juveniles collected in Burnaby, BC and a single male collected in Saanichton, BC. Specimens were examined and illustrated using a Zeiss dissecting microscope (illustrations of male structures

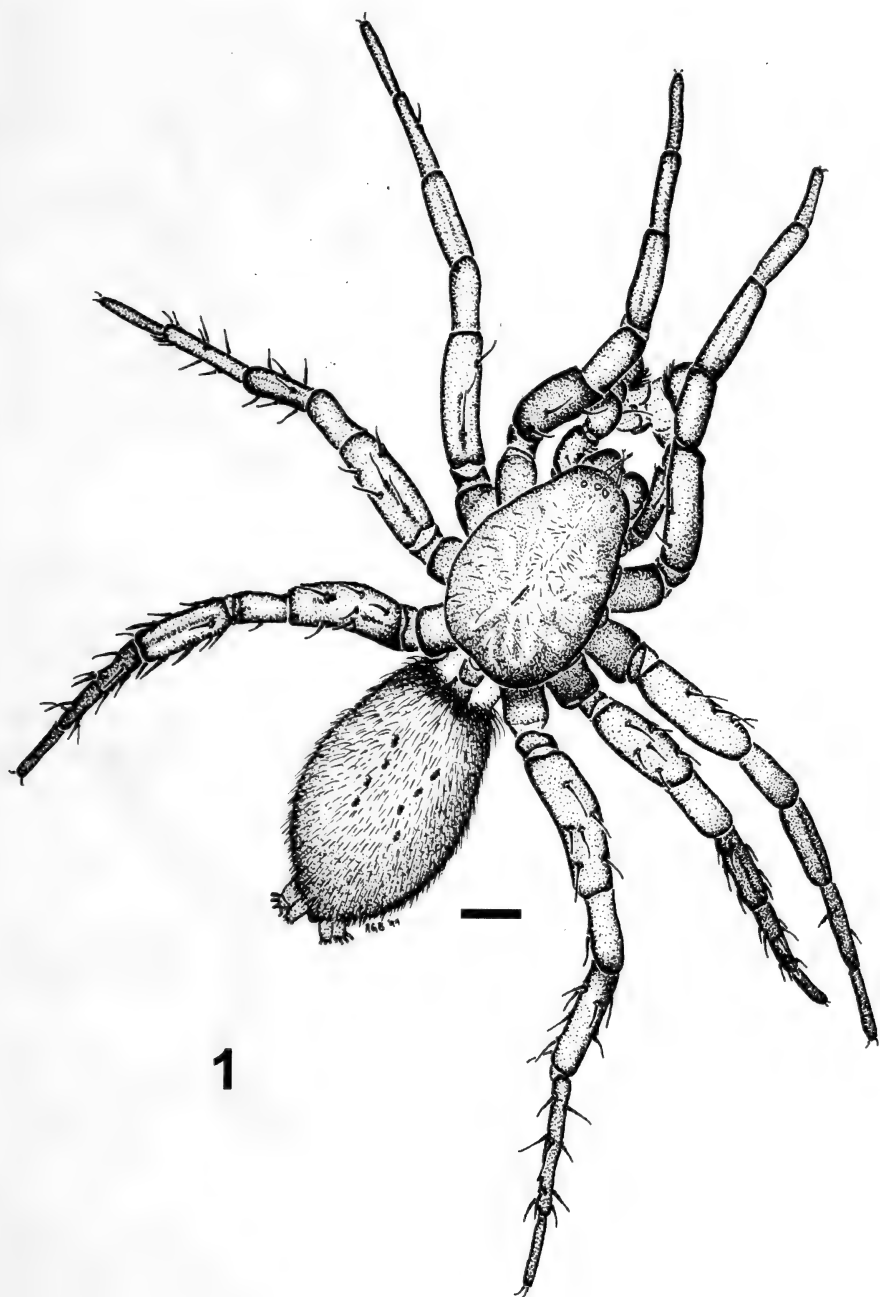


FIGURE 1. *Gnaphosa snohomish*, male habitus, Burnaby, British Columbia, dorsal. Scale bar=1.0 mm.

and female epigynum, all measurements) or a Nikon phase contrast compound microscope (illustrations of cleared female genitalia). Measurements are expressed in mm and are presented as sample range (mean  $\pm$  standard deviation). Within the descriptive text, the following abbreviations are used: measurements: CL=carapace length, CW=carapace width, SL=sternum length, SW=sternum width. Acronyms of depositories: AMNH=American Museum of Natural History, New York, New York; DJB=private collection of D. J. Buckle, Saskatoon, Saskatchewan; CNC=Canadian National Collection, Ottawa, Ontario; RBCM=Royal British Columbia Museum, Victoria, British Columbia; UWBM=University of Washington, Burke Museum, Seattle, Washington.

**Modified key to species.** Platnick and Dondale (1992: 170, Fig. 256 and key couplet 8(7)) described and figured the embolus of *G. snohomish* as enlarged basally and then gradually narrowing distally. In reality, the embolus narrows abruptly distal to the enlarged base (this paper, Figs. 2, 4, 5). A corrected version of couplet 8 is presented below. Female key couplets in Platnick and Dondale (1992) are generally sufficient for identifying *G. snohomish*; couplet 16 is slightly reworded below for clarity.

- 8 (7) Embolus with variably sized spine on distal margin of embolus base (this paper, Figs. 2, 4, 5) .....*G. snohomish* Platnick and Shadab
- Embolus lacking spine on distal margin of embolus base (Platnick and Dondale 1992, Fig. 260) .....*G. antipola* Chamberlin
- 16 (14) Spermathecal head short and slender (Platnick and Dondale 1992, Fig. 255) .....*G. clara* (Keyserling)
- Spermathecal head longer, usually stouter (this paper, Figs. 8, 9; Platnick and Dondale 1992, Figs. 259, 263, 267) .....17

*Gnaphosa snohomish* Platnick and Shadab (Figs. 1-9)

*Gnaphosa snohomish* Platnick and Shadab, 1975: 52, Figs. 123-126; Crawford, 1988: 30; West et al., 1988: 84; Platnick and Dondale 1992: 170, Figs. 256-259; Bennett et al., 2006.

**Types.** Male holotype (and female paratype) from Chase Lake (Edmonds, 47°47'51"N, 122°20'48"W), Snohomish County, Washington, USA; collected April 1957 (B. Malkin); in AMNH, not examined (vouchers from this study compared with holotype and paratype and identity confirmed by N. I. Platnick, AMNH).

**Diagnosis.** *Gnaphosa snohomish* was placed within the *lugubris* species group by Platnick and Shadab (1975) but, more probably, it is a member of the *lucifuga* group (*sensu* Ovtsharenko et al. 1992): those *Gnaphosa* species possessing an embolus situated prolaterally on the genital bulb, denticles ventrally on the embolus base, and epigynum with divided lateral margins. Among such species, *G. snohomish* is only likely to be confused with *G. antipola* Chamberlin. It is distinguished from *G. antipola* by its possession of a single large spine (in addition to the denticles) ventrally on the embolus base (Figs. 4, 5)

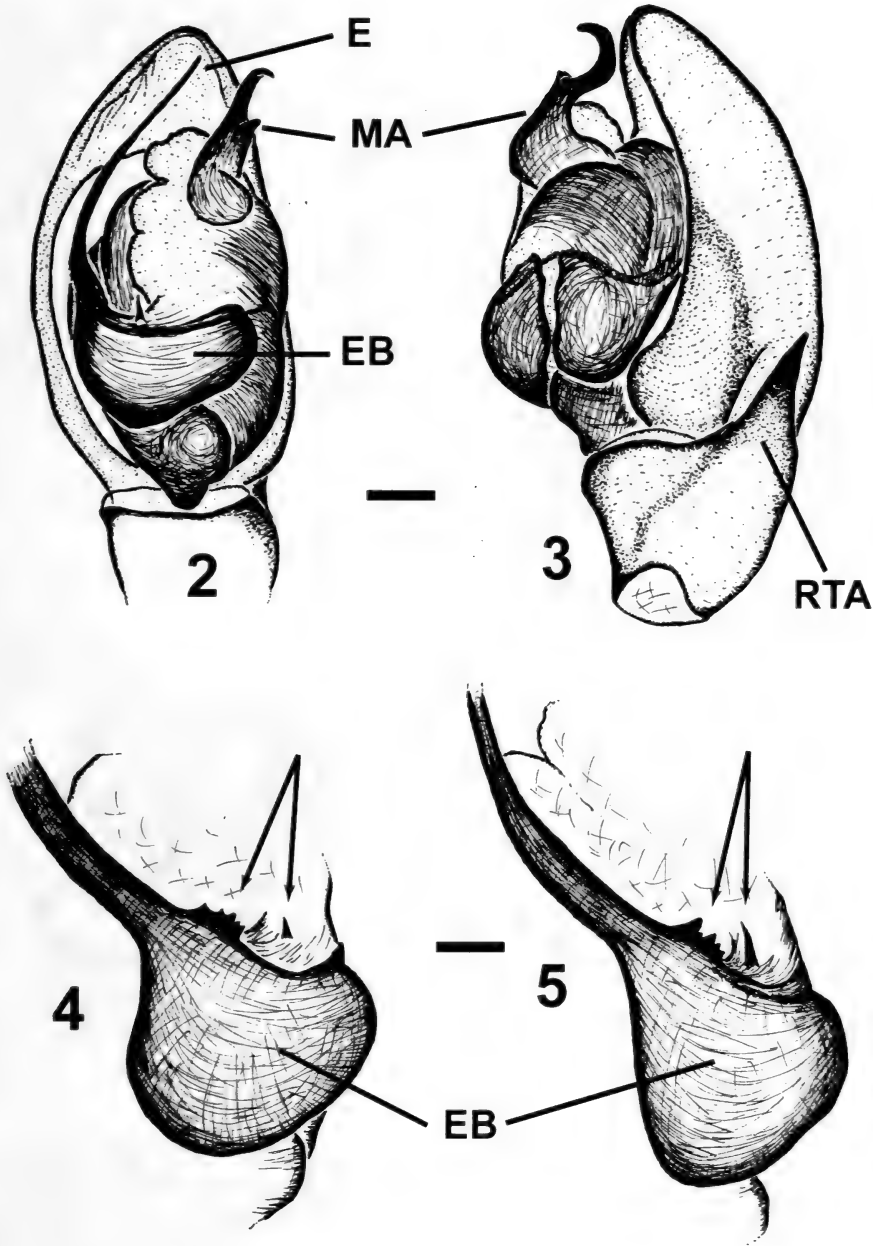


FIGURE 2-5. *Gnaphosa snohomish*, male palpal characters, Burnaby, BC. 2–left palpus, genital bulb, ventral; 3–same, retrolateral; 4 & 5–bases of left emboli of two specimens showing variation in basal spine and denticles, prolateral. Scale bars=0.2 mm (Figs. 2, 3) and 0.1 mm (Figs. 4, 5). Unlabelled arrows indicate spine and denticles on embolus base. E=embolus, EB=embolus base, MA=median apophysis, RTA=retrolateral tibial apophysis.

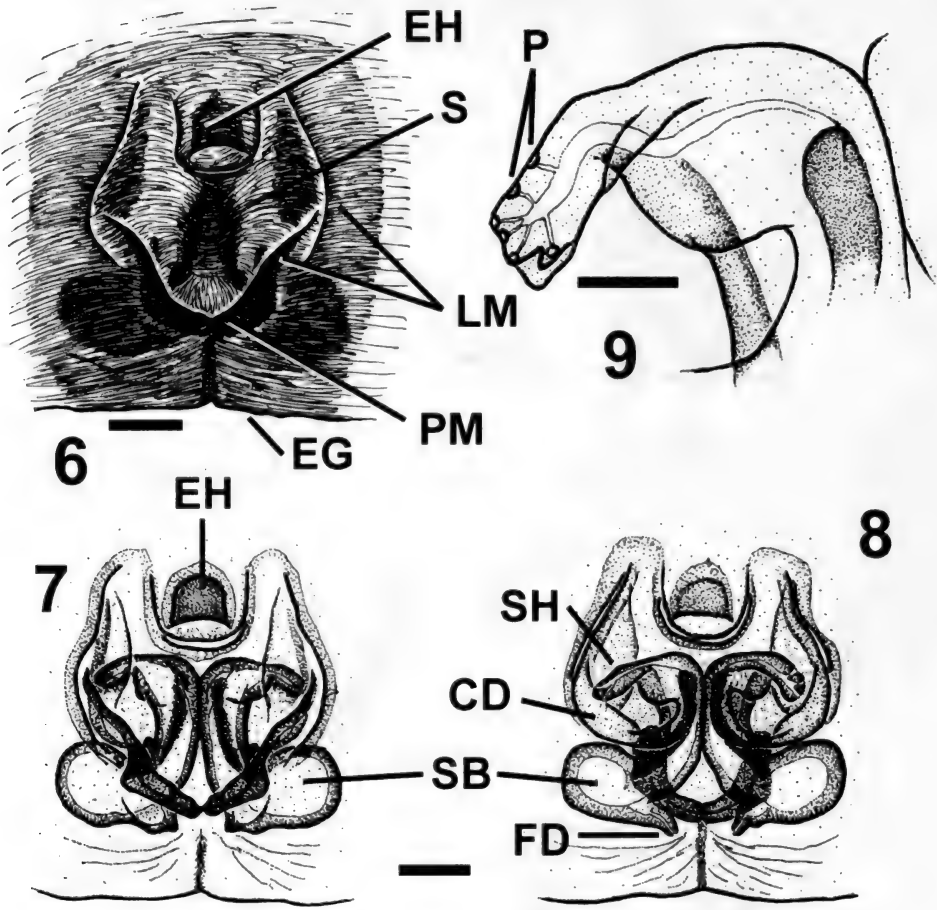


FIGURE 6-9. *Gnaphosa snohomish*, female genitalic characters, Burnaby, BC. 6–epigynum, ventral; 7–cleared vulva, ventral; 8–same, dorsal; 9–same, detail of Fig. 8 (spermathecal head), dorsal. Scale bars=0.1 mm (Figs. 6-8) and 0.05 mm (Fig. 9). CD=copulatory duct, EG=epigastric groove, EH=epigynal “hood,” FD=fertilization duct, LM=lateral margins of epigynum, P=simple spermathecal pores, PM=posterior margin of epigynum, S=epigynal “septum,” SB=spermathecal base, SH=spermathecal head.

and by the relatively smaller epigynal “hood” (Figs. 6-8, also compare Platnick and Shadab 1975, Figs. 121 and 125).

**Description.** A medium-sized, moderately dark species of *Gnaphosa* (Fig. 1) with little size difference between the sexes; see Platnick and Shadab (1975) and Ovtsharenko et al. (1992) respectively for descriptions of the genus (and, also, species characteristics not described below) and the *lucifuga* species group.

**Male.** N=20. Total length 7.44-9.92 ( $8.62 \pm 0.78$ ). CL 2.75-4.09 ( $3.67 \pm 0.35$ ), CW 2.05-2.98 ( $2.72 \pm 0.25$ ), SL 1.36-1.98 ( $1.81 \pm 0.15$ ), SW 1.24-1.74 ( $1.57 \pm 0.12$ ). Holotype total length 6.62, CL 2.85, CW 2.27 (Platnick and Shadab 1975). Retrolateral tibial apophysis (Fig. 3) simple, acuminate, about as long as palpal tibia; median apophysis (Figs. 2, 3) distally located on genital bulb, bifurcate, sickle-shaped in retrolateral view (Fig. 3); embolus (Figs. 2, 4, 5) originating proximally on genital bulb, enlarged basally, abruptly narrowed distally, with single, variably sized spine on distal edge of embolus base and variable series of denticles ventrally at beginning of narrowed part of embolus.

**Female.** N=20. Total length 7.44-11.78 ( $9.70 \pm 1.24$ ). CL 2.67-4.46 ( $3.73 \pm 0.43$ ), CW 1.92-3.22 ( $2.67 \pm 0.33$ ), SL 1.36-2.05 ( $1.82 \pm 0.18$ ), SW 1.18-1.92 ( $1.59 \pm 0.17$ ). Paratype total length 8.14, CL 3.10, SW 2.30 (Platnick and Shadab 1975). Epigynum (Fig. 6) with shallow “hood” anteriorly, paired lateral margins (heavily sclerotized posteriorly), and broad “septum” with medial longitudinal trough; copulatory ducts (Fig. 8) difficult to differentiate, apparently leading posteriorly from lateral epigynal margins then arching anteriorly along vulval midline to connect with spermathecal heads; spermathecal heads (Figs. 8, 9) directed towards lateral epigynal margins and bearing simple pores; broad duct connecting each spermathecal head and base; spermathecal bases (Figs. 7, 8) rounded with fertilization ducts exiting from posterior medial margins.

**Material examined (Fig. 10). CANADA, British Columbia:** Burnaby “Marshlands”, SW of Marine Dr. & North Fraser Way, 49°11'43"N, 122°58'35"W, all by J. Troubridge and deposited variously among AMNH, CNC, and RBCM, 21 May 1998, 18♂, 5♀, 29 May 1998, 19♂, 12♀, 7 juv., 5 June 1998, 16♂, 6♀, 12 juv., 28 June 1998, 9♂, 5♀, 15 juv., 8 July 1998, 12♂, 8♀, 21 juv., 5 September 1998, 29♂, 13♀, 4 juv.; Island View Beach, Saanichton, BC, 48°34'57"N, 123°22'19"W, RGB, 26 May–29 June 2003, ♂, RBCM.

**Other material (Fig. 10). CANADA, British Columbia:** Haney, UBC Research Forest, Maple Ridge, ~49°17'48"N, 122°34'37"W, ~360 m, 20 June 1968, ♀, DJB, 30 June 1968, ♀, ♂, DJB. **UNITED STATES, Washington:** **Clallam Co.**, Pat's Prairie, 47°59' N, 123°13' W, 815 m, R. Crawford, 16 May 1992, ♂, UWBM; **Grays Harbor Co.**, Carlisle Bog, 47°08' N, 124°05' W, 27 m, R. Crawford, 30 May 1992, 3♀, 3 juv., UWBM; **King Co.**, Kings Lake Bog, 47°35' N, 121°46' W, 293 m, R. E. Nelson, 21 July 1981, 2♀, 1 juv., UWBM; **Skagit Co.**, Big Lake Bog, 48°20' N, 122°11' W, 128 m, R. Crawford, 9 October 1994, ♂, 2♀, 4 juv., UWBM; **Thurston Co.**, marsh on Green Cove Creek, 47°04' N, 122°57' W, 43 m, September–December 1992, ♂, UWBM.

## Discussion

Collection records suggest a one year life cycle with overwintering of sub-adults and maturation beginning late the following spring.

*Gnaphosa snohomish* is probably endemic to the Puget Sound / Georgia Basin region where it is known only from nine localities: six in northwestern Washington (the type locality as well as five other sites around or near Puget Sound (R. L. Crawford pers. comm.)) and three in southwestern British Columbia (Bennett et al. 2006). West et al. (1988) listed Haney, BC as the locality for specimens of *Gnaphosa* “near *snohomish*” collected by D. Buckle and R. G. Holmberg. Buckle (pers. comm.) has confirmed these specimens to be “true” *G. snohomish*. All the collection sites feature substantial wetlands and at least seven of these are peat bogs.

In British Columbia, the Burnaby collection is from an extensive historical peat bog site occurring near sea level along the north shore of the Fraser River estuary. The collection site was characterized by hummocks of peat and other mosses overlain with cranberry (*Oxycoccus macrocarpus* (Ait.) Pursh (Ericaceae)), sundew (*Drosera rotundifolia* L. (Droseraceae)), rushes (*Juncus* spp. (Juncaceae)), and various grasses. A detailed listing

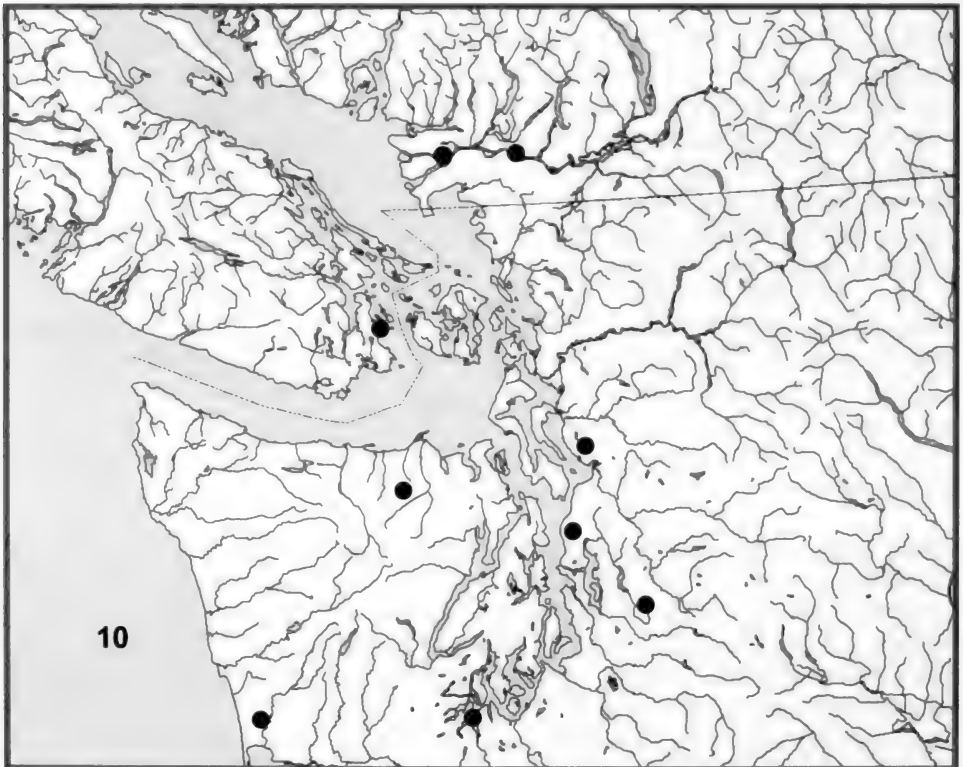


FIGURE 10. Southwestern British Columbia and northwestern Washington State: *Gnaphosa snohomish* collection localities.

of the plants associated with the site is contained in Troubridge et al. (1998). The Haney UBC Research Forest contains at least one well-established floating peat bog (L. Marczak and J. McLean pers. comm.); a popular collecting site, it is likely that the Haney specimens came from this bog. Other peatland sites are known in the Georgia Basin area such as Bowser Bog (Bowser, Vancouver Island), Burns Bog (Richmond, also situated in the Fraser River estuary just south of the Burnaby site), and Yellow Point Bog (Ladysmith, Vancouver Island). These sites are well known to entomologists and, although we are aware of no intensive sampling specifically for spiders at these sites, no specimens of *G. snohomish* have been collected from them or from other wetlands (other than the Saanichton site) elsewhere in British Columbia. The single Saanichton male came from a site that was extensively sampled for spiders in 2003 and 2004 (Bennett and Salomon unpublished data), although lacking nearby peatlands, the site is adjacent to a well established *Potentilla* (Rosaceae) marshland.

In Washington, all but one of the collections are from confirmed peatland sites (R. L. Crawford pers. comm.) in or near the Puget Sound area. The type locality is a small, low elevation floating bog in the heart of Edmonds and now completely surrounded by housing. Pats Prairie and Carlisle, Kings Lake, and Big Lake Bogs are sphagnum bogs occurring at a range of elevations from near sea level to over 800 m. No habitat details are available for the Green Cove Creek “marsh” site. Sampling of Washington peatland sites east of the Cascade Range (outside of the Puget Sound area) has produced no *G. snohomish* specimens (R. L. Crawford pers. comm.).

The available collection data suggest that *G. snohomish* is a true tyrphobiont (an obligate peatland associate) with a very limited range. All but two of over 200 specimens were found in sphagnum bogs occurring as discrete and isolated habitat patches (as is typical of temperate peatlands (Spitzer and Danks 2006)) within the Puget Sound / Georgia Basin area and only at one of the bog sites (Burnaby) have significant numbers of specimens been noted. Tryphobiontic spider species are not well studied or numerous and, at least in Canada, appear to be dominated by linyphiids and lycosids (Dondale and Redner 1994). Only 9 probable tyrphobiontic species (all linyphiids and lycosids) were noted among 198 spiders recorded at 6 peatland sites in southern Ontario and southwestern Quebec (Dondale and Redner 1994). Although various species of gnaphosid genera, including *Gnaphosa*, can be common in bogs (e.g. see Blades and Marshall 1994; Dondale and Redner 1994; Platnick and Dondale 1992), members of the family are more typically associated with open, drier habitats (Ubick 2005).

We are aware of no probable tyrphobiontic gnaphosid in North America other than *G. snohomish*.

The Burnaby *G. snohomish* collection site has been extensively modified and reactivated as an operational commercial cranberry bog. A small (~9 ha) nature reserve is adjacent to the northeast corner of the cranberry bog but otherwise the area is dominated by agricultural and commercial development and heavy industry. The nature reserve is a damp site dominated by shrubby vegetation, especially birches (*Betula* sp. (Betulaceae)), scrubby pines (*Pinus* sp. (Pinaceae)), hardhack (*Spiraea douglasii* Hook. (Rosaceae)), Himalayan blackberry (*Rubus discolor* Weihe and Nees (Rosaceae)), and fireweed (*Epilobium angustifolium* L. (Onagraceae)). Although no further spider sampling has been undertaken in the immediate area, the nature reserve may be the only potential habitat remaining in the

immediate area available to support a population of *G. snohomish*. The current status of the species in the area is unknown and it may have been extirpated there.

### Acknowledgements

We are grateful to Randy May for access to the Burnaby site (and for waiting until after the pitfall trapping was completed to convert the site to commercial cranberry production), to Norm Platnick and Don Buckle for confirming the identity of our and the Haney specimens respectively, to Pierre Paquin for discussion about bog specialist spiders, to Rod Crawford for supplying data on Washington State specimens and bog sites, to Laurie Marczak and John McLean for information on peatlands in the UBC Research Forest, to Malcolm Gray and Stephen Sutherland for providing the base map, and to an anonymous reviewer for excellent suggestions for improvement of the manuscript. This paper is affectionately dedicated to Gary Umphrey and, especially, the memory of Dave "D. H." Pengelly: Gary first recognized Bennett's arachnological interests and introduced him to "D. H." For better or for worse, these two entomologists were responsible for setting Bennett on his meandering (but persistent) pursuit of taxonomic fulfillment.

### References

- Bennett, R. G., D. Blades, D. Buckle, C. D. Dondale, and R. C. West. 2006. The spiders of British Columbia. <http://www.efauna.bc.ca/>. Accessed 1 September 2006.
- Blades, D. C. A. and S. A. Marshall. 1994. Terrestrial arthropods of Canadian peatlands: Synopsis of pan trap collections at four southern Ontario peatlands. *Memoirs of the Entomological Society of Canada* 169: 221-284.
- Crawford, R. L. 1988. An annotated checklist of the spiders of Washington. *Burke Museum Contributions in Anthropology and Natural History* 5:1-48.
- Dondale, C. D. and J. Redner. 1994. Spiders (Araneae) of six small peatlands in southern Ontario or southwestern Quebec. *Memoirs of the Entomological Society of Canada* 169: 33-40.
- Ovtsharenko, V. I., N. I. Platnick, and D. X. Song. 1992. A review of the north Asian ground spiders of the genus *Gnaphosa* (Araneae, Gnaphosidae). *Bulletin of the American Museum of Natural History* 212: 1-88.
- Platnick, N. I. 2006. The World Spider Catalog, Version 7. The American Museum of Natural History. <http://research.amnh.org/entomology/spiders/catalog/index.html>. Accessed 1 September 2006.
- Platnick, N. I. and C. D. Dondale. 1992. The insects and arachnids of Canada. Part 19. The ground spiders of Canada and Alaska (Araneae: Gnaphosidae). *Agriculture Canada Publication* 1875. 297 p.
- Platnick, N. I. and M. U. Shadab. 1975. A revision of the spider genus *Gnaphosa* (Araneae, Gnaphosidae) in America. *Bulletin of the American Museum of Natural History* 155: 1-66.

- Spitzer, K. and H. V. Danks. 2006. Insect biodiversity of boreal peat bogs. *Annual Review of Entomology* 51: 137-161.
- Troubridge, J., S. Fitzpatrick, R. G. Bennett, and P. Catling. 1998. Pestiferous and predatory arthropods on an abandoned cranberry farm in British Columbia. Poster presented at the Annual General Meeting of the Entomological Society of Canada (Quebec City, PQ, October 1998) and the North American Cranberry Research and Extension Workers Conference (Long Beach, WA, September 1999).
- Ubick, D. 2005. Gnaphosidae. pp. 106-111 *In* Spiders of North America: an identification manual. D. Ubick, P. Paquin, P. E. Cushing, and V. Roth (eds.), American Arachnological Society.
- West, R. C., C. D. Dondale, and R. A. Ring. 1988. Additions to the revised checklist of the spiders (Araneae) of British Columbia. *Journal of the Entomological Society of British Columbia* 85: 77-86.



## A NEW SPECIES OF *WIEDEMANNIA* ZETTERSTEDT FROM GRAND CANYON NATIONAL PARK, WITH NOTES ON ADDITIONAL NEARCTIC SPECIES (DIPTERA: EMPIDIDAE)

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### Abstract

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*Wiedemannia digna* sp. nov. is described from Grand Canyon National Park (Arizona, USA) and additional records of *W. apicalis* Sinclair, *W. lepida* (Melander), and *W. simplex* (Loew) are listed. An updated key to North American species is also provided.

Published July 2007

### Introduction

With the description of a new species below, there are now seven species of *Wiedemannia* known from North America. The rarest species remains *W. vexillum* Sinclair, known only from the holotype collected in the Northwest Territories. In addition to the description of a new species, new locality records for *W. lepida* (Melander), *W. apicalis* Sinclair, and *W. simplex* (Loew) discovered since the last revision of this genus (Sinclair 1998) are provided.

Adult *Wiedemannia* are common on emergent rocks in large creeks and rivers where there is little overhead riparian vegetation (i.e., sunny, exposed sites). In North America, species of *Wiedemannia* are confined to northern and western regions, ranging from beyond the treeline in northern Canada south to New Mexico and Arizona (Sinclair 1998). There are no records of this genus further south into Mexico or Central and South America.

### Materials and Methods

This study is based on Diptera housed or deposited in the Canadian National Collection of Insects, Ottawa, Ontario (CNC), Colorado State University, Fort Collins, Colorado (CSU), University of Guelph, Guelph, Ontario (DEBU), United States National Museum of Natural History, Washington, DC (USNM), and Zoologisches

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Terms used for adult structures primarily follow those of McAlpine (1981). Homologies for the male terminalia follow Sinclair (2000). To facilitate observations, the male terminalia were macerated in hot 85% lactic acid and immersed in glycerine.

### Key to the Nearctic species of *Wiedemannia* (updated from Sinclair 1998)

1. Acrostichals biserial, extending to the scutellum .....2
- Acrostichals inconspicuous, extending at most to second dorsocentral bristle .....5
2. Base of apical filament of phallus with flag-like structure bearing stout spines .....*W. vexillum* Sinclair
- Note: Females of *W. vexillum* and *W. digna* are unknown. Females of *W. undulata* Sinclair and *W. simplex* (Loew) are generally indistinguishable, but may be tentatively separated on the basis of geographic distribution and association with males. See Sinclair (1998).
- Base of apical filament of phallus lacking flag-like structure with stout spines .....3
3. Ocellar bristles distinctly shorter than scutal bristles, ca. two-thirds length of the postpronotal bristles .....*W. digna* sp. nov.
- Ocellar bristles subequal in length to scutal bristles .....4
4. Anterior and posterior lobes of clasping cercus of similar length; setae of inner surface of posterior lobe straight, much shorter than width of lobe .....*W. simplex* (Loew)
- Anterior lobe of clasping cercus half length of posterior lobe; most setae of inner surface of posterior lobe sinuous, 2-2.5 times longer than width of lobe .....*W. undulata* Sinclair
5. Anteroapical margin of wing with a distinct dark spot between  $R_{2+3}$  and  $R_4$  .....*W. apicalis* Sinclair
- Anteroapical margin of wing with faint cloudy spot between  $R_{2+3}$  and  $R_4$  or spot lacking .....6
6. Width of gena equal to half height of eye; acrostichals extending to almost second dorsocentral bristle; apical margin of wing lacking cloudy spot; 5-7 dorsocentral bristles present .....*W. lepida* (Melander)
- Width of gena less than half height of eye; acrostichals not extending posterior of first dorsocentral bristle; apical margin of wing with a faint cloudy spot, or sometimes inconspicuous; 5 dorsocentral bristles present .....*W. uncinata* Sinclair

*Wiedemannia apicalis* Sinclair

*Wiedemannia apicalis* Sinclair, 1998: 340.

**Recognition.** This species is readily distinguished by its distinctive darkened wing tips.

**Material examined.** CANADA, British Columbia: Kootenay NP, Radium Hot Springs, Sinclair Ck, 1020 m, 9 September 2003, 17 September 2005, B. J. Sinclair, 19♂, 10♀, CNC, DEBU, ZFMK. UNITED STATES, Montana: Glacier NP, 11 August 1993, P. H. Arnaud Jr., 2♀, USNM.

**Geographical distribution and seasonal occurrence.** This species is rarely encountered when compared to other species of *Wiedemannia* from western North America. It was previously known from scattered localities along the Rocky and Sierra Nevada Mountain ranges in California, Colorado, Idaho, Nevada, and Utah (Sinclair 1998).

These records represent the first known occurrence of this species from Montana and Canada and extend its distribution range much further north. In the cold mountain stream in Kootenay NP, *W. apicalis* was collected together with *Clinocera fuscipennis* Loew, *C. lecta* Melander, and *Trichoclinocera rupestris* Sinclair.

*Wiedemannia digna* sp. nov.

**Etymology.** The specific name is from the Latin *dignus* (worthy, deserving, honourable), in recognition of Prof. D. H. Pengelly's dedication to entomology and to the University of Guelph Insect Collection.

**Type Material.** Holotype male labelled: "USA:AZ:Grand Canyon NP/ Vasey's Paradise/ 10.v.1998/ J.F. MacDonald" (USNM). Paratype: Same data as holotype, ♂, USNM.

**Recognition.** This species is distinguished from the other large-sized species of *Wiedemannia* by the reduced ocellar bristles which are shorter than the thoracic bristles, lateral margin of the scutum with blue pruinescence, and the form of the clasping cercus with its broad posterior lobe.

**Description. Male.** Face, gena, and postocciput with blue pruinescence, vertex brown; ocellar setae short, ca. two-thirds postpronotal bristle. Width of gena less than one-third height of eye. Arista short, tip blunt. Setae on palpus dark.

Pleura, prescutellar depression, postpronotal lobe, lower notopleuron, and scutellum with blue pruinescence; scutum faintly bivittate. Acrostichals biserial, diverging around prescutellar depression, extending onto scutellum; 5 dorsocentral bristles, 1-2 short setae interspersed; 1 postpronotal bristle and several short setae; 1 presutural supra-alar bristle; 2 notopleural bristles; 0 postsutural supra-alar bristles; 1 postalar bristle; 2 scutellar bristles and inner and outer marginal setae; scattered setae on notopleuron and presutural supra-alar regions. Postnotum with patch of pale setae; anteprenotum with pale setae.

Wing broad, faintly infusate; stigma elongate; single basal costal seta. Anal vein reduced to streak; cell dm elongate, M acutely branched or  $M_1$  and  $M_2$  separated;  $R_4$  and  $R_5$  straight and divergent.

Coxae with blue pruinescence, remaining segments dark. All legs with evenly distributed setae. Anterior surface of fore femur lacking macrosetae. Fifth tarsomere with dorsoapical extension; empodium pulvilliform, subequal to length of claw.

Abdominal sternites, lateral portion of tergites, and hypopygium with blue pruinescence. Tergite 8 bilobed. Phallus straight, distiphallus with median swelling; ejaculatory apodeme long and narrow. Surstylus small and pointed. Cercal plate with macrosetae confined to dorsal tubercle. Claspig cercus mitten-shaped, anterior lobe ("thumb") much shorter than posterior ("fingers") lobe; anterior lobe slightly longer than wide somewhat tapered to narrow apex, shiny and lacking blue pruinescence; posterior lobe expanded apically, somewhat rounded, bearing long lateral setae subequal to width of posterior lobe; setae of inner surface short, pale, with expanded or clubbed tips especially on anterior lobe (Fig. 1).

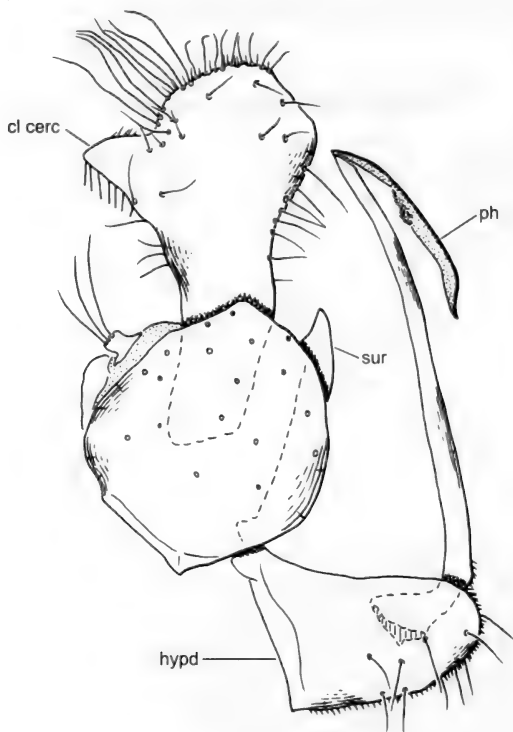


FIGURE 1. Male terminalia of *Wiedemannia digna* sp. nov., lateral view. Abbreviations: cl cerc—claspig cercus; hypd—hypandrium; ph—phallus; sur—surstylus.

**Female.** Unknown.

**Geographical distribution and seasonal occurrence.** *Wiedemannia digna* is currently known only from the type locality, collected in May. The specimens were collected from a large spring stream on the western side of Marble Gorge at mile 32 of the Colorado River at Vasey's Paradise (J. MacDonald pers. comm.). The stream emerged about 50-70 m above the river and flowed down over the talus slope to the Colorado River. The specimens were collected from large boulders just above the water line of this spring stream.

**Phylogenetic relationships.** *Wiedemannia digna* is very closely related to *W. simplex* and *W. undulata*, which are also found in the region. This complex of species forms the *W. simplex* group and also includes several European species (see Sinclair 1998).

### ***Wiedemannia lepida* (Melander)**

*Clinocera lepida* Melander, 1902: 241.

**Recognition.** Males are distinguished by their subtriangular to rounded clasping cercus (Sinclair 1998).

**Material examined.** UNITED STATES, Colorado: Garfield Co., Grizzly Ck, I-70 rest-stop, 2 July 1996, H. Evans, S. Fitzgerald, B. Kondratieff, D. Leatherman, 2♂, 14♀, CSU.

**Geographical distribution and seasonal occurrence.** This species is found in streams along the coast and Cascade ranges from southern British Columbia to California and along the Rocky Mountains from British Columbia to Wyoming and Colorado (Sinclair 1998). The above specimens represent a new county record for Colorado. The species was previously known from Boulder (Boulder Falls), Routt (Steamboat Springs), and Larimer (Youngs Gulch, Sheep/Buckhorn Creeks) counties.

### ***Wiedemannia simplex* (Loew)**

*Clinocera simplex* Loew, 1862: 207.

**Recognition.** Males are distinguished by the characters provided in the above key to species.

**Material examined.** UNITED STATES, Arizona: Yavapai Co., Oak Creek Canyon near Sedona, 10 August 2004, K. Yoshizawa, 3♂, 1♀, CNC. Coconino Co., Oak Creek Canyon, Cave Springs Cpgd, 4500', 21 May 1971, P. H. & M. Arnaud, 11♂, 14♀, USNM.

**Geographical distribution and seasonal occurrence.** This species is widely distributed in rivers in the far north of North America, with several records known from the Rocky

Mountains (Sinclair 1998). *Wiedemannia simplex* is also recorded from several isolated populations in Arizona (Navajo County: White River, west of Fort Apache) and New Mexico (Grant and Catron counties). The above specimens represent new county records for Arizona.

### Acknowledgments

John MacDonald (Purdue University) collected the new species while working on a National Park Service project headed by John Spence (Glen Canyon National Recreation Area), and his efforts and kindness are greatly appreciated. Steve Marshall (DEBU) is thanked for organizing these special issues in memory of my first entomology professor, Dave Pengelly. Scott Fitzgerald kindly arranged for the loan of several clinocerines from Colorado State University. Norm Woodley arranged the loan from the USNM and Dr. K. Yoshizawa (Hokkaido University) kindly provided additional specimens. John MacDonald and Jeff Cumming (CNC) reviewed earlier drafts of the paper.

### References

- Loew, H. 1862. *Diptera Americae septentrionalis indigena*. Berliner Entomologische Zeitschrift 6: 185-232.
- McAlpine, J. F. 1981. Morphology and terminology—adults. [Chapter] 2. pp. 9-63. *In* Manual of Nearctic Diptera. Vol. 1. J. F. McAlpine, B.V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood (eds.), Agriculture Canada Monograph 27, Ottawa.
- Melander, A. L. 1902. Monograph of the American Empididae. Transactions of the American Entomological Society 28: 195-368.
- Sinclair, B. J. 1998 (1997). Review of the Nearctic species of *Wiedemannia* Zetterstedt (Diptera: Empididae: Clinocerinae). *Studia dipterologica* 4(2): 337-352.
- Sinclair, B. J. 2000. Morphology and terminology of Diptera male terminalia. pp. 53-74. *In* Contributions to a Manual of Palaearctic Diptera 1. L. Papp and B. Darvas (eds.), Science Herald, Budapest.

## ABUNDANCE AND SPECIES OF BUMBLE BEES (HYMENOPTERA: APOIDEA: BOMBINAE) IN FIELDS OF CANOLA, *BRASSICA RAPA* L., IN MANITOBA: AN 8-YEAR RECORD

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### Abstract

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Bumble bees, *Bombus* spp., were inadvertently captured in Unitraps® baited with a bertha armyworm (*Mamestra configurata* Wlk.) sex attractant placed in fields of canola (oilseed rape, *Brassica rapa* L.) in four regions within the agricultural zone of Manitoba, 1986-1993. *Bombus rufocinctus* Cresson and *B. borealis* Kirby were the most abundant species, occurring in all four regions. Another 13 species were much less abundant. Species diversity and number of captures were greatest in the northwestern region (Swan River Valley), and least in the southeast (Red River Valley), coinciding with the amount of native vegetation in the region. Captures of *Bombus* spp. were largest in 1989, with smaller peaks in 1992, 1986, and 1993. The patterns of abundance among regions were very similar among years, suggesting that the abundance of bumble bees is controlled by weather-related factors, even though analyses of the temperature and precipitation during summer, winter, and the spring periods when queens are establishing new colonies did not reveal any relationships.

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### Introduction

During the period 1986-1993, sex-attractant traps were being used to predict the abundance of the bertha armyworm, *Mamestra configurata* Wlk. (Noctuidae: Lepidoptera),

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a pest of canola (oilseed rape, *Brassica rapa* L.) (Turnock 1987). The traps were placed in canola fields throughout the flowering period and captured bumble bees, *Bombus* spp. as well as the target species. The bumble bees found in the traps were identified and counted. Our objectives were to describe the abundance and species composition of the bumble bee fauna in canola fields in Manitoba from 1986-1993, and to examine the annual changes in relation to physiographic area and weather. The data also provide a baseline for evaluating long term changes in the abundance of these pollinators in the agricultural area of Manitoba.

## Methods

The traps used in this study were Unitraps® baited with a sex attractant for the bertha armyworm. In the first year (1986), we used yellow-green-white traps, which collected a large number of bumble bees. Experiments in Lethbridge, Alberta, on the effect of different colours of sex attractant traps for bertha armyworm, indicated that all-green traps were much less attractive to bumble bees than were traps of other colours (J. R. Byers, pers. comm., 20 November 1986). To conserve bumble bees, we used all-green traps in subsequent years. The lure was a mixture of 1.0 mg (Z)-11-hexadecen-1-ol acetate and 0.05 mg of (Z)-9-tetradecen-1-ol acetate (Underhill et al. 1977) impregnated in a red rubber septum (Steck et al. 1979).

Two traps, each 1 m above ground, were placed in each field of canola sampled. They were 100 m apart, 10 m in from the field margin, and where wind movement was not obstructed by nearby trees or tall shrubs. Inside the collecting bucket of each trap was a 15 mm square of insecticidal strip (Vapona®). The traps were deployed in mid June and examined at least every 2 weeks until early August. This included the full flowering period of canola. The total trapping period was about 7 weeks per year. At each collection time, the insects were removed from the trap and the bumble bees were subsequently pinned, labelled, identified to species, and counted. Badly damaged specimens that could not be identified to species, were discarded. The remaining bees were identified by L. Dumouchel and T. Laverty. Voucher specimens are deposited in the R. B. Wallace Museum, Department of Entomology, University of Alberta.

The canola fields in which traps were placed changed each year, because of crop rotation, but the selected fields in each area were within 10 km of each other, and often much closer. In most fields, the seed had been mixed with granular carbofuran before planting, for flea beetle control (Lamb and Turnock 1982), but none of the fields had additional insecticidal applications. The regions sampled were selected in response to the presence of populations of the bertha armyworm, which were most abundant in the Swan River Valley (Turnock 1987). Therefore, this region was sampled for eight years (1986-1993) and had 4-10 traps per year, but the other regions were sampled for fewer years (4-5) and had 2-6 traps per year.

The sampling locations, named after the nearest town, were situated in four distinct regions of the agricultural area of Manitoba (Fig. 1). The topography and original vegetation of these regions is described in detail by Smith et al. (1998) and Weir (1983).

The Swan River Valley Region (Durban, Kenville, Minitonas, Swan River, and Bowsman) is located in an area where the Manitoba Escarpment was breached in post-

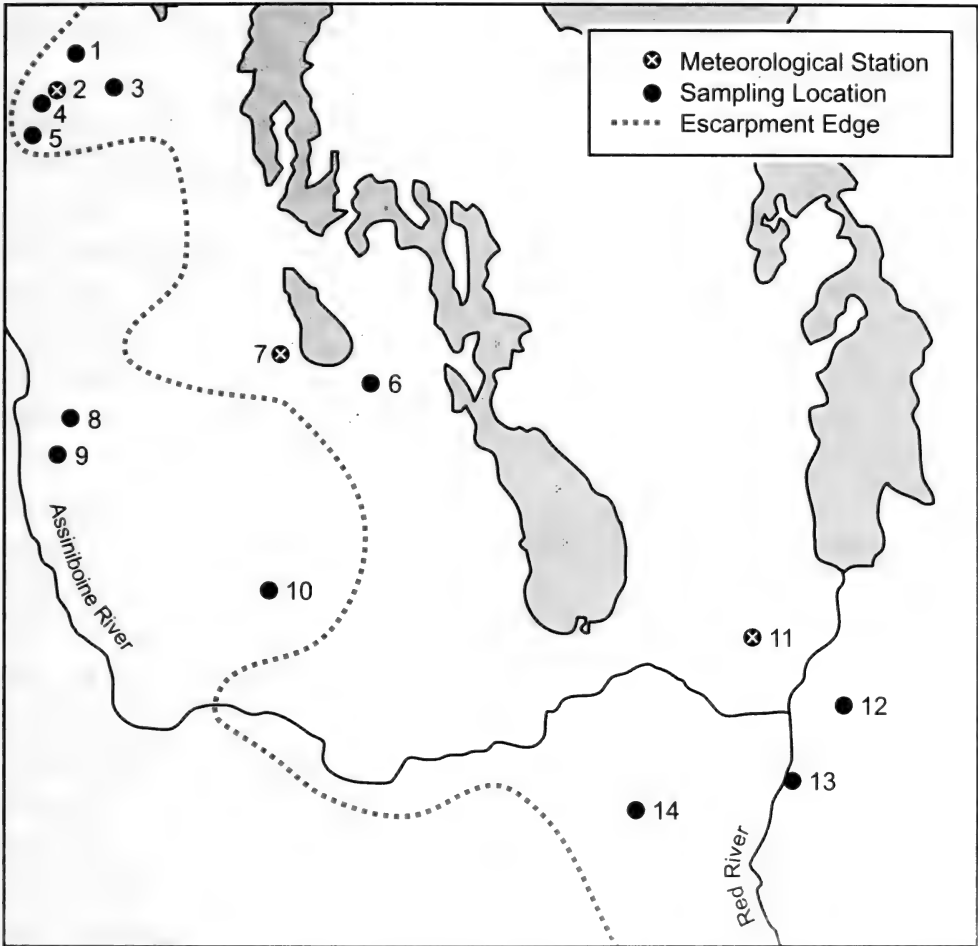


FIGURE 1. Map of southern Manitoba, showing the sampling locations: Location 1=Bowsman, 2=Swan River, 3=Minitonas, 4=Kenville (Swan River Valley Region); 5=Durban; Location 6=Ste. Rose, 7=Dauphin (Manitoba Lowlands Region); Location 8=Bield, 9=Russell, 10=Basswood (Western Uplands Region); Location 11=Stonewall, 12=Dugald, 13=Glenlea, 14=Carman (Red River Valley Region).

glacial times. The topography varies from flat to gently rolling and was originally forested by deciduous and coniferous trees.

The Western Upland Region (Basswood, Russell, and Bield) lies above the Manitoba Escarpment. The topography varies from rolling, near the edge of the Escarpment, to quite flat in areas further west. The original vegetation was a mixture of grassland with forest dominated by Trembling Aspen (*Populus tremuloides* Michx).

The Manitoba Lowlands Region (Dauphin and Ste. Rose du Lac) lies in the Manitoba Lowlands in the northwestern part of the Lake Manitoba Plain Ecoregion (Smith

et al. 1998). This region is generally flat, with thin and poorly-drained soils. The original vegetation was grassland and wetlands, with groves of deciduous trees.

The Red River Valley Region (Glenlea, Dugald, Stonewall, and Carman) is also part of the Lake Manitoba Plain Ecoregion, but in this southerly region, the soils are deeper and more fertile than in the Manitoba Lowlands area. The topography is level to gently sloping, and the soil is poorly drained. The original vegetation included tall grass prairie and extensive stands of deciduous forest.

The natural vegetation in all of the regions has been heavily modified by agriculture, but some trees and shrubs occurred on the headlands around most of the sampled fields. Trees and shrubs were least abundant in the Red River Valley and Manitoba Lowlands, and more abundant in the Western Uplands and the Swan River Valley. No major changes in land use occurred in any region during the years of sampling. The sampling sites were in the main canola growing areas of Manitoba, and although the area of canola varied from 352 100 to 627 600 ha in the years 1986-1993 (Anon. 1986-1993), there was always canola growing in the sampling areas.

All of the sampling locations were located along the northern boundary of the Cold Temperate Continental Zone (Trewartha and Horn 1980). This zone has warm to hot summers and cold winters. The impact of low winter air temperatures in this zone on insects overwintering on or below the soil surface is ameliorated by a generally deep and persistent snow cover, particularly in treed areas (Turnock and Fields 2005).

We calculated the following weather parameters for each of the years 1985-1993 for a representative meteorological station for the Swan River Valley (Swan River), the Manitoba Lowlands (Dauphin), and the Red River Valley (Stony Mountain). These included the summer of 1985 and the winter of 1985-86 which preceded the beginning of sampling. Suitable data for a weather station in the part of the Manitoba Uplands in which the traps were located were not available. Weather data were obtained by Agriculture and Agri-Food Canada from the Environment Canada database as part of the cooperative agreement for scientific research with the Environmental Service of Environment Canada. The summer weather (1 April–31 October) is described by the sum of degree-days above 5°C (DD05) and the total precipitation (mm). The winter weather (1 November–31 March) is described by the sum of degree-days below -10°C ( $DD \leq -10$ ) and the total snowfall (cm). Mated queens of *Bombus* spp. emerge from hibernation and attempt to establish colonies from early spring to early summer (Curry 1984) and wet spring weather is detrimental to the establishment of colonies (Harder 1986). We calculated the mean temperature, total rainfall, and number of days with rain for the period 15 May to 15 June, for each year, for comparison with catch records.

The nonparametric Mann–Whitney U statistic (Siegel 1956) was used to test the hypothesis that the abundance and diversity of bumble bees captured in 1986 differed from the captures in other years. The ‘ $\alpha$  diversity’ index, or species richness (Magurran 1988) was calculated for each region and year. Nonparametric rank correlation (Siegel 1956) and the Pearson product moment correlation (Zar 1998) were used to determine the correlation between diversity and abundance.

## Results and Discussion

No bees were collected until the canola began to flower, about 1 week after the traps were set out. Most captures occurred during the peak period of flowering, usually from the last week of June to mid July, but a few bees were captured into early August.

The 'α diversity index' (Table 1) was correlated with abundance, significantly with the nonparametric rank correlation ( $R=0.49$ ), and not significantly by the Pearson Product moment correlation ( $R_s=0.19$ ). The number of bumble bees captured in 1986 (yellow-green-white traps) differed significantly from the abundance in other years (green traps) (Mann-Whitney test,  $U=54$ ,  $P<0.002$ ) but the difference in diversity was not significant (Mann-Whitney test,  $U=37$ ,  $P>0.2$ ). The occurrence of *B. rufocinctus* Cresson and *B. borealis* Kirby did not change between 1986 and the other years, but it did change for *B. perplexus* (Cresson), *B. sandersoni* Franklin, *B. nevadensis* (Cresson), *B. terricola* Kirby, *B. ashtoni* (Cresson), *B. vagans* Smith, and *B. ternarius* Say. In the Swan River Valley, nine species captured in 1986 were subsequently either not captured (three species) or captured in lower numbers (six species) (Table 1). The results for the Western Uplands and Manitoba Lowlands were similar to those in the Swan River Valley. The numbers of *B. rufocinctus* and *B. borealis* were higher in at least one of the years when the green traps were used than in 1986. Among the less abundant species, *B. fervidus* (Fabricius) was slightly more abundant, and *B. insularis* (Smith) as abundant, as in the year when the green traps were used. There were seven species in the Western Uplands and six species in the Manitoba Lowlands that were recorded in 1986 but not in subsequent years (Table 1). Trap colour seemed to have affected the less abundant species, but the location of the fields and of traps within fields in relation to topography and surrounding vegetation could have had a greater effect, obscuring the colour effect.

### Species distribution and diversity

There were a total of 15 *Bombus* species (Table 1). The number of species varied from 12 (Swan River Valley) to 4 (Red River Valley) (Table 1). Only one species, *B. rufocinctus*, was found in all regions and in all years. *Bombus borealis* was found in all regions and in all years except 1990, when it was not collected in the Western Uplands and Manitoba Lowlands regions (Table 1). Four species, *B. terricola*, *B. ashtoni*, *B. vagans*, and *B. ternarius*, were recorded from all regions except the Red River Valley. Species with a more northwesterly distribution included *B. insularis*, *B. sandersoni*, and *B. nevadensis* in the Swan River Valley and Western Uplands regions, *B. perplexus* in the Swan River Valley and Manitoba Lowlands regions, and *B. suckleyi* Greene and *B. centralis* Cresson in the Swan River Valley. *Bombus huntii* Greene occurred in the Western Uplands and Manitoba Lowlands regions, *B. fervidus* in the Western Uplands and Red River Valley regions, and *B. griseocollis* (DeGeer) only in the Red River Valley.

Three species (*Psithyrus* spp.) that are social parasites in the nests of other bumble bee species, *B. (Ps.) ashtoni*, *B. (Ps.) insularis*, and *B. (Ps.) suckleyi*, occurred in the Swan River Valley, *B. ashtoni* and *B. insularis* in the Western Uplands, and only *B. ashtoni* in the Manitoba Lowlands. None of these species were collected in the Red River Valley.

TABLE 1. Number of bumble bees (*Bombus* spp) per trap, by species and year, captured in sex attractant traps located in canola fields in four areas of Manitoba. The traps were yellow–green–white in 1986, and solid green in all other years. Three species that are social parasites in the nests of other bumble bee species are included: *B. (Psithyrus) ashtoni*, *insularis*, *suckleyi*.

Species	1986	1987	1988	1989	1990	1991	1992	1993
Swan River Valley (Durban, Kenville, Minitonas, Swan River, Bowsman)								
<i>rufocinctus</i>	8.2	3.2	2.8	103.2	0.2	3.8	16.2	17.8
<i>borealis</i>	1.5	0.2	1.0	9.6	0.2	1.6	12.9	3.2
<i>insularis</i>	0.6	0.3	0.1	0.5	0.0	0.1	0.1	0.0
<i>perplexus</i>	0.2	0.0	0.0	0.0	0.1	0.1	1.2	0.5
<i>terricola</i>	8.9	0.0	0.0	0.4	0.0	0.1	0.0	0.0
<i>vagans</i>	1.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0
<i>ternarius</i>	2.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0
<i>sandersoni</i>	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0
<i>ashtoni</i>	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>nevadensis</i>	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>centralis</i>	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>suckleyi</i>	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.0
Other spp.	3.6 <sup>1</sup>	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Bombus</i> (unident.)	0.1	0.0	0.0	0.0	0.8	0.0	1.1	0.0
Sum	27.1	4.9	3.9	113.8	1.4	5.8	32.1	21.5
N traps	10	10	10	8	8	8	8	4
α diversity	11	5	3	4	3	5	8	3
Western Uplands (Bield, Russell, Basswood)								
<i>rufocinctus</i>	4.0	4.8	7.5	81.0	1.5			
<i>borealis</i>	0.7	0.3	0.2	2.0	0.0			
<i>insularis</i>	0.3	0.0	0.3	0.0	0.0			
<i>fervidus</i>	0.2	0.0	0.0	0.5	0.0			
Other species	6.0 <sup>2</sup>	0.0	0.0	0.0	0.0			
<i>Bombus</i> (unident.)	0.2	0.0	0.0	0.0	0.0			
Sum	15.2	10.7	11.5	75.5	1.5			
N traps	6.0	6.0	6.0	2.0	2.0			
α diversity	11.0	2.0	3.0	3.0	1.0			
Manitoba Lowlands (Ste–Rose, Dauphin)								
<i>rufocinctus</i>	1.5	1.2	2.5	88.0	0.0			
<i>borealis</i>	0.5	0.0	0.2	7.0	0.0			
Other species	6.0 <sup>3</sup>	0.0	0.0	0.0	0.0			
<i>Bombus</i> (unident.)	0.2	0.0	0.0	0.0	0.0			
Sum	6.2	1.2	2.8	95.0	0.0			
N traps	4.0	4.0	4.0	2.0	2.0			
α diversity	8.0	1.0	2.0	2.0	0.0			

TABLE 1. continued.

Species	1986	1987	1988	1989	1990	1991	1992	1993
Red River Valley (Stonewall, Dugald, Glenlea, Carman)								
<i>rufocinctus</i>	1.1	1.6	8.8	3.2				
<i>borealis</i>	0.1	0.0	0.6	0.2				
Other species	0.0	0.0	0.1 <sup>4</sup>	0.2 <sup>5</sup>				
<i>Bombus</i> (unident.)	0.2	2.5	0.0	0.2				
Sum	1.5	4.1	9.5	3.7				
N traps	8.0	8.0	8.0	6.0				
$\alpha$ diversity	2.0	1.0	3.0	3.0				

<sup>1</sup> Bees/trap: *ashtoni*–3.4; *nevadensis*–0.1; *centralis*–0.1.  
<sup>2</sup> Bees/trap: *terricola*–4.8; *vagans*–0.3; *ternarius*–2.0; *sandersoni*–0.2; *ashtoni*–1.7; *nevadensis*–0.2; *huntii*–0.7.  
<sup>3</sup> Bees/trap: *perplexus*–0.5; *terricola*–1.8; *vagans*–0.5; *ternarius*–0.2; *ashtoni*–0.8; *huntii*–0.2.  
<sup>4</sup> *fervidus*.  
<sup>5</sup> *griseocollis*.

Abundance

The number of bumble bees/trap varied from none to 113.5 among regions and years (Table 1). In the Swan River Valley, the highest numbers occurred in 1989 (114/trap), 1992 (32/trap), 1986 (27/trap), and 1993 (22/trap). There were fewer than 10/trap in the other years (Table 1). The two most abundant species, *B. rufocinctus* and *B. borealis*, showed the same pattern of abundance. The rarer species did not have any clear trends in abundance. The pattern of abundance was similar in the other regions. In the Western Uplands and Manitoba Lowlands regions, numbers were also highest in 1989, lower in 1986, and very low in the other years. The peak year in the Red River Valley was also 1989.

The consistency in the trend of captures among years in all regions strongly suggests the impact of a physical factor, probably weather. Summer and winter temperatures and precipitation were similar among regions and showed similar trends among years. We examined the relationships among the weather factors and population trends for all four regions, but present data only for the Swan River region, which had the longest run of bumble bee captures.

In Swan River, these weather parameters and the mean temperature, total rainfall, and days with rain during the spring (18 May–14 June) did not show any clear relationships with the number of bees/trap (Table 2). High populations in one year did not predispose high populations in the next year, although populations did increase through 1990-1992 and 1987-1989. The high numbers in 1989, followed by the low in 1990, were associated with warm summers in 1988 and 1989, followed by moderately cold winters. The low numbers in 1990 cannot be related to any of the weather factors examined.

Although one or more weather factors may determine the annual variations in bumble bee numbers across the four regions of Manitoba, the differences among regions

TABLE 2. Weather data: degree days above 5°C (DD05), precipitation (Precip.) in mm of rain or cm of snow, and number of rainy days at Swan River in relation to number of bees/trap, Swan River Valley Region.

Year	Bees/trap (log X +1)	Previous summer		Previous winter			Spring		Summer	
		1 April - 3 October	1 November - 31 March	DD	Snow (cm)	Tmean (°C)	Precip. (mm)	Rainy days	1 April - 31 October DD 05	Precip. (mm)
		DD 05	Precip. (mm)							
1989	113.8 (2.06)	1903	382	≤10	76	12.3	108	10	1864	448
1992	32.1 (1.52)	1826	415	492	83	13.7	28	7	1431	418
1986	27.1 (1.45)	1504	394	764	114	16.2	37	5	1656	499
1993	21.5 (1.35)	1431	418	492	83	10.6	80	15	1341	467
1991	5.8 (0.83)	1694	352	842	78	17.1	44	9	1826	415
1987	4.9 (0.77)	1656	499	359	76	14.8	56	11	1826	464
1988	3.9 (0.69)	1826	464	666	127	19.8	36	8	1903	382
1990	1.4 (0.38)	1864	448	798	144	14.8	52	12	1694	352

within years in both abundance and diversity seem to be controlled by other factors. Native vegetation near the fields influence bumble bee numbers (Morandin and Winston 2005), and captures were consistently higher in the Swan River Valley than in the regions where native vegetation was less abundant (Smith et al. 1998).

There is no evidence to indicate that pesticide usage differed among regions. Poor (cool, rainy) weather when the queens are establishing their nests in the spring may affect population numbers (Sladen 1912; Free and Butler 1959; Alford 1975; Harder 1986) but our data do not indicate such a relationship. Spillover of pathogens from commercial to wild populations may negatively affect wild populations (Colla et al. 2006), but bumble bees have not been used commercially in Manitoba glasshouses.

Research on bumble bees has neglected the factors controlling their abundance, and the general approach to the subject needs to be supplemented with experiments on overwintering survival, and colony establishment and growth.

### Acknowledgments

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### References

- Alford, D. V. 1975. Bumblebees. Davis-Poynter, London.
- Anon. 1986-1993. Market Analysis and Statistics Section. Economics Branch. Manitoba Agriculture Yearbook. Manitoba Agriculture, Winnipeg, MB.
- Colla, S. R., M. C. Otterstatter, R. J. Gegear, and J. D. Thomson. 2006. Plight of the bumble bee: Pathogen spillover from commercial to wild populations. *Biological Conservation* 129(4): 461-467.
- Curry, P. S. 1984. Bumble bees of Saskatchewan (Hymenoptera: Apidae): a survey of their geographic distribution. Saskatchewan Museum of Natural History. Contribution No. 5. Saskatoon, SK.
- Free, J. B. and C. G. Butler. 1959. Bumblebees. Collins, London. 208 pp.
- Harder, L. D. 1986. Influences on the density and dispersion of bumble bee nests (Hymenoptera: Apidae). *Holarctic Ecology* 9:99-103.
- Lamb, R. J. and W. J. Turnock. 1982. Economics of insecticidal control of flea beetles (Coleoptera: Chrysomelidae) attacking rape in Canada. *The Canadian Entomologist* 114: 827-840.
- Magurran, A. E. 1988. Ecological diversity and its measurement. Princeton University Press. Princeton, N. J.
- Morandin, L.A. and M. L. Winston. 2005. Wild bee abundance and seed production in conventional, organic, and genetically modified canola. *Ecological Applications* 15: 871-881.

- Siegel, S. 1956. Non-parametric statistics for the behavioral sciences. McGraw-Hill Book Co. New York, Toronto, London.
- Sladen, F. W. L. 1912. The Humble Bee. Its life history and how to domesticate it. Macmillan. London.
- Smith, R. E., H. Veldhuis, G. F. Mills, R. G. Eilers, W. R. Fraser, and G. W. Lelyk. 1998. Terrestrial Ecozones, Ecoregions, and Ecodistricts, an Ecological Stratification of Manitoba's Natural Landscapes. Technical Bulletin 98-9E. Land Resource Unit, Brandon Research Centre, Research Branch, Agriculture and Agri-Food Canada, Winnipeg, MB.
- Steck, W., E. W. Underhill, M. D. Chisholm, C. C. Peters, H. G. Philip, and A. P. Arthur. 1979. Sex pheromone traps in population monitoring of adults of the bertha armyworm, *Mamestra configurata* (Lepidoptera: Noctuidae). The Canadian Entomologist 111: 91-95.
- Trewartha, G. T. and L. H. Horn. 1980. An Introduction to Climate. McGraw-Hill. 415 pp.
- Turnock, W. J. 1987. Predicting larval abundance of the Bertha Armyworm, *Mamestra configurata* Wlk., in Manitoba from catches of male moths in sex attractant traps. The Canadian Entomologist 119: 167-178.
- Turnock W. J. and P. G. Fields. 2005. Winter climates and coldhardiness in terrestrial insects. European Journal of Entomology 102: 561-576.
- Underhill, M. D., W. F. Steck, and M. D. Chisholm. 1977. A sex pheromone mixture for the bertha armyworm moth, *Mamestra configurata*: (Z)-11-hexadecen-1-ol acetate. The Canadian Entomologist 109: 1335-1340.
- Weir, T. R. (Ed.). 1983. Atlas of Manitoba. Manitoba Surveys and Mapping Branch. Government of Manitoba. Winnipeg, MB.
- Zar, J. H. 1998. Biostatistical analysis (4<sup>th</sup> ed.). Prentice Hall, Upper Saddle River, New Jersey.

***BAEODROMIA*, A NEW GENUS OF TACHYDROMIINE FLY  
FROM THE NEW WORLD  
(DIPTERA: EMPIDOIDEA; HYBOTIDAE)**

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**Abstract**

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*Baeodromia* n. gen. (Hybotidae: Tachydromiinae: Drapetini) is described to include *Baeodromia pleuritica* (Melander) n. comb., a species from eastern North America originally described in the genus *Stilpon* Loew. The new genus also includes several, as yet undescribed species from the Neotropical Region. The phylogenetic relationships of *Baeodromia* within the tribe Drapetini are discussed.

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**Introduction**

In a revision of the Nearctic species of the tachydromiine genus *Stilpon* Loew, Cumming and Cooper (1992) excluded the eastern North American species *Stilpon pleuriticus* Melander, indicating that it belongs to an undescribed genus. The purpose of this paper is to describe and validate this new genus, which also contains several undescribed Neotropical species (referred to as "Undescribed Genus A" by Cumming and Sinclair (in press) in their key to genera of Central American and Mexican Empidoidea, exclusive of Dolichopodidae s. str.). The new genus belongs to the tachydromiine tribe Drapetini as characterized by Sinclair and Cumming (2006). The phylogenetic relationships of the new genus to other drapetine genera are also discussed based on current knowledge.

**Materials and Methods**

**Materials.** This study was based on examination of specimens from the institutions (including curators in brackets) listed below. Acronyms given here are used throughout the text to indicate the depository of specimens. CAS—Department of Entomology, California Academy of Sciences, San Francisco, California (P. H. Arnaud). CNC—Canadian National Collection of Insects and Arachnids, Agriculture and Agri-Food Canada, Ottawa, Ontario. DEBU—Insect Collection, Department of Environmental Biology, University of Guelph, Guelph, Ontario (M. Buck and S. A. Marshall). NCSR—Department of Entomology, North Carolina State University, Raleigh, North Carolina (R. L. Blinn). UNHC—Entomology

Museum, Department of Entomology, University of New Hampshire, Durham, New Hampshire (D. S. Chandler). USNM—National Museum of Natural History [formerly United States National Museum], Smithsonian Institution, Washington, DC, (N. E. Woodley).

**Methods.** Terms used for structures primarily follow those of McAlpine (1981) and those used in Cumming and Cooper (1992). Homologies of the male terminalia follow those of Cumming et al. (1995), as modified by Sinclair (2000) and Sinclair and Cumming (2006). The figure of the hypopygium (i.e., Fig. 5) was drawn in right lateral view to show most of the components, because of the rotated and asymmetrical nature of male terminalia in the Tachydromiinae. Label data for the holotype of *Stilpon pleuritica* Melander is cited in full, following the system described by O'Hara (1983), with the depository for the type given.

## Systematics

### *Baeodromia* n. gen.

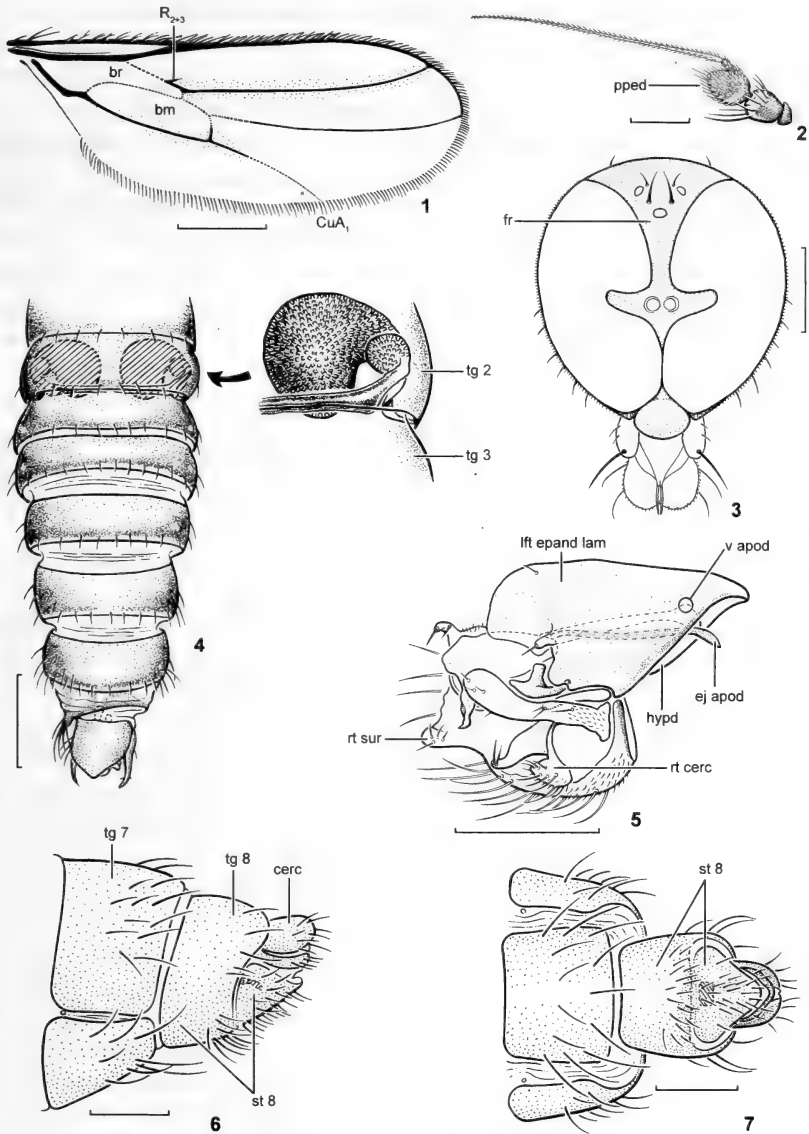
**Type species.** *Stilpon pleuritica* Melander, 1928, by present designation.

**Etymology.** The generic name is derived from the Greek word *baios* for small or little, in reference to the very small size of the included species in the genus, and *dromia*, the common tachydromiine suffix for runner. The gender is feminine.

**Diagnosis.** Adults of *Baeodromia* are distinguished from those of other drapetine genera by a combination of the head with eyes contiguous on face and frons divergent above (Fig. 3), antenna with small ovate postpedicel and dorsoapical arista-like stylus (Fig. 2), wing with cell br much shorter than cell bm at apex (Fig. 1), male abdomen with lateral vessel-like glands under at least tergite 2, relatively small asymmetrical male terminalia with slender ventral apodeme in addition to long ejaculatory apodeme (Fig. 5), and female terminalia characterized by tergite 8 and sternite 8 fused laterally into a ring segment with sternite 8 portion hinged apically to cover genital opening (Figs. 6, 7). Characteristics of the tribe Drapetini are reviewed in the Discussion section.

**Description.** Length 1.0–2.0 mm.

**Male. Head.** Ground color light brown to black. Eyes with ommatrichia (=microscopic pubescence); eyes contiguous on face (Fig. 3); facets not enlarged below antennae. Gena not extended below eye. Frons with sides divergent above; narrow above antennae, minimum width only slightly greater than width of median ocellus. One pair of long slightly convergent ocellar setae; one pair of short slightly divergent postocellar setae; one pair of convergent vertical setae; a few occipital setae ventrally. Frons, vertex, occiput, and gena lightly covered in tomentum. Antennae arising near middle of head; scape small; pedicel globose, with several long ventral preapical setae; postpedicel (= first flagellomere) small, ovate, with long arista-like stylus arising dorsoapically (Fig. 2); segments ivory yellow to light brown, paler than head color. Palpus ivory to yellow; elongate-ovate with distinct



FIGURES 1-7. *Baeodromia pleuritica* (Melander). 1. Wing; 2. Antenna; 3. Head, frontal view, antennae removed; 4. Male abdomen dorsal view, with enlarged inset showing internal detail of right lateral vessel-like gland; 5. Male terminalia, right lateral view; 6. Female terminalia, left lateral view; 7. Female terminalia, ventral view. Abbreviations: bm-basal medial cell; br-basal radial cell; cerc-cercus;  $CuA_1$ -cubital vein; ej apod-ejaculatory apodeme; fr-frons; hypd-hypandrium; lft epand lam-left epandrial lamella; pped-postpedicel;  $R_{2+3}$ -2<sup>nd</sup> radial vein; rt cerc-right cercus; rt sur-right surstylus; st- sternite; tg-tergite; v apod-ventral apodeme. Scale bars=0.1 mm, except Fig. 4 where scale bar=0.2 mm.

apical seta. Proboscis slightly recurved. **Thorax.** Ground color yellowish brown to black. Thoracic macrotrichia relatively thin and short; 1 long postpronotal pair, 2 long notopleural pairs, 1 long postalar pair, 1 short subapical scutellar pair, and 1 long apical scutellar pair of setae; acrostichal setulae in 2 rows, incomplete posteriorly; dorsocentral setulae (including intra-alars) in 4 rows; 1 postpronotal and 1 supra-alar pair of setulae. Postpronotal lobe undifferentiated. Scutum entirely tomentose; postalar callus partially differentiated; scutellum entirely tomentose. Katepisternum shiny, remainder of mesopleuron tomentose. Metakatepisternum shiny; metaepimeron large, tomentose. Halter ivory to yellow. **Wing.** Broad and blunt-tipped; hyaline to slightly infusate, with darker infuscation arranged along longitudinal veins (Fig. 1); costa with slightly lengthened basal setae;  $R_5$  originating half way to slightly beyond half way along  $R_1$ ;  $R_{2+3}$  complete in most species, abbreviated before reaching costa (or almost absent) in most specimens of *B. pleuritica* (Melander); cell br short, ending well before apex of cell bm; crossvein bm-cu nearly transverse;  $CuA_1$  slightly arched and reaching wing margin, faint apically in *B. pleuritica* (Melander);  $CuA_2$  and  $A_1$  absent. **Legs.** Short with ground color ivory or yellow to brown. Fore femur moderately to markedly thickened, with pair of prominent ventral preapical setae. Mid femur slender to barely thickened, with pair of prominent anteroventral preapical setae. Hind leg slender; femur with pair of anteroventral preapical setae; tibia not expanded apically. **Abdomen.** Segments 1-7 lightly sclerotized, subequal in length; segment 8 short, partially concealed by segment 7. Lateral vessel-like glands under at least tergite 2, with apparent ducts exiting along posterior margin (probably including intersegmental membrane) of tergite (Fig. 4). Tergites 4 and 5 without squamiform lateral setae. **Terminalia.** Hypopygium relatively small (Fig. 4), asymmetrical, and rotated 90 degrees to the right with most components of the left side reduced in size (Fig. 5). Epandrium completely divided; left epandrial lamella fused to hypandrium; left surstylus short and not divided into components; right epandrial lamella relatively large, positioned ventrally; right surstylus broad. Cerci, including subepandrial sclerite, fused together basally; left cercus long, digitiform; right cercus short. Internally with rod-shaped ejaculatory apodeme and long slender ventral apodeme.

**Female.** Similar to male except abdominal tergites 1-6 very weakly sclerotized and without setae; lateral vessel-like glands lacking. Terminalia (Figs. 6, 7) with tergite 8 fused laterally to sternite 8 forming ring segment; sternite 8 portion of ring segment with apex hinged as a cover for genital opening; sternite 9 (=genital fork) visible as small internal sclerite; tergite 10 absent; sternite 10 positioned below proctiger, desclerotized basomedially; cercus small. In one undescribed species from Costa Rica (Monteverde, 1500 m) known only from females (CNC), the wing is reduced to tiny stubs and the halter is vestigial.

**Included species.** The genus currently includes *Baeodromia pleuritica* (Melander) **n. comb.** from eastern North America and at least nine undescribed species from the Neotropical Region (Mexico, Guatemala, Belize, Costa Rica, Dominican Republic, Dominica, Venezuela, and Brazil). Each of the undescribed species is at present known from one or two specimens (often only females) and therefore description of these new species will be deferred until additional material is acquired.

***Baeodromia pleuritica* (Melander) n. comb.**

*Stilpon pleuritica* Melander 1928: 302.

*Stilpon* (*Tetraneurella*) *pleuriticus* Melander: Melander 1965: 476.

'*Stilpon*' *pleuriticus* Melander: Cumming and Cooper 1992: 980.

**Type material examined.** HOLOTYPE, male labelled: "FRANCONIA, N[ew] H[ampshire]."; "TYPE/ pleuritica/ Mel[ander]. [red label]" (USNM). Melander (1928) described this species from a single specimen collected by Mrs. Slosson from the White Mountains of New Hampshire. The holotype from Franconia, Mrs. Slosson's hometown in the White Mountains, is a male specimen with somewhat retracted terminalia, rather than a female as Melander (1928) reported.

**Other material examined.** CANADA, **Manitoba:** Ninette, ex. *Betula glandulosa*, 15 July 1958, ♂, ♀, CNC. **New Brunswick:** Kouchibouguac N[at]. P[k]., Code-5466F, 2 July 1977, 2♂, CNC. **Nova Scotia:** Cranberry I[sland], Lockeport, in mouse run among *Carex*, 31 July 1958, ♂, CNC. **Ontario:** Crieff Bog, 3 km W. Puslinch, pt3a sedge meadow, 18-24 July 1987, ♀, DEBU; Damascus, Luther Marsh Bog, Rot T[ra]p, August–October 1984, ♀, DEBU; Gananoque, 18 km E., 9 June-15 July 1977, ♂, 2♀, CNC; Guelph, [University] Arboretum, mushroom traps, 12-14 July 1984, ♀, DEBU; Kaladar, 1 July 1969, ♂, USNM; Mer Bleue, Ottawa, in sphagnum bog, 19 July 1963, ♀, CNC; Mer Bleue, Ottawa, in marsh, 25 June 1964, 3♀, CNC; Richmond, 11 July 1978, ♂, CNC. **Quebec:** Harrington L[ake], Gatineau Pk., 3 July 1963, ♀, CNC; Lac Phillipe, 45°37' N, 76°[10']W, 5 August 1955, ♂, CNC. **UNITED STATES, Florida:** Archibold Biol[ogical] Sta[tion], Lake Placid, 1 October 1979, ♀, CNC; Bradenton, 4 July 1986, 4♀, CNC; Gainesville, 25 April 1952, ♂, CNC. **Georgia:** McIntosh Co., Sapelo Island, live oak forest, F[light] I[n]tercept T[rap], 20 June-18 July 1987, ♂, CNC. **Indiana:** Perry Co., In.145, 1.5 mi N. of I-64, shaded weeds & grass, 13 July 1982, ♂, CNC. **Kentucky:** Mammoth Cave Nat. Pk., 23 August 1981, ♀, CNC. **Maryland:** Thurmont, 8 June 1962, ♂, 8♀, CNC. **Massachusetts:** Brewster, 8 August 1964, ♀, CNC; Concord, 17 July 1961, ♀, USNM; Holliston, 6 July, ♀, CNC. **Michigan:** Benton Harbor, orchard sweeps, 17 June 1941, ♀, USNM. **New Hampshire:** Straff[ord] Co., Spruce Hole, 3 mi SW Durham, sweep on mat, 23 July 1987, ♀, UNHC. **New York:** Adirondacks, Connery Pond, 15 July 1938, ♀, USNM. **North Carolina:** Bladen Co., Singletary Lk. St. Pk., 34°35'N, 78°27'3"W, malaise [trap], 19-22 May 2003, debu00227321, ♀, DEBU; **Brunswick Co.,** near Longwood, pit fall trap soybean field 3A1 Ag1, 1 August 1979, ♂, NCSR; Franklin, 2000', on ground among *Carex* roots, 8 May 1957, 7♂, 4♀, CNC; Franklin, 2000', 10 June 1957, ♂, CNC; **Graham Co.,** Robbinsville, 9 June 1976, ♂, CAS; Highlands, 3800', 1 June 1957, 3 June 1957, 6 June 1957, 2♂, ♀, CNC; Gr[eat] Smoky Nat. Pk., Mingus Creek nr. Cherokee, 2000', 29 May 1957, ♀, CNC. **Virginia:** Montgomery Co., 8 km NW Blacksburg, 1000 m, M[alaise] T[rap] Rural, 4 June 1987, ♂, 2♀, CNC.

**Diagnosis.** Antennae with basal segments ivory to yellow, postpedicel and arista-like stylus slightly darker, yellow to light brown; wing length 1.5-1.75X length of head + thorax; R<sub>2+3</sub> abbreviated (Fig. 1) or sometimes absent, rarely complete (see below under Remarks); legs

ivory yellow to light brown, hind femur with apex darker brown; male fore femur with basal row of anteroventral setae; male fore tibia with apical row of short ventral setae; male mid femur with row of short stout ventral setae; male hind basitarsus not dilated; male with vessel-like gland under each side of abdominal tergite 2, not present under subsequent tergites (Fig. 4); male terminalia with left surstylus short and pointed, right epandrial lamella with long setae, right surstylus broad with two apical projections, left cercus elongate and curved (Fig. 5); female terminalia with tergite 8 portion of ring segment broad medially (Fig. 6).

**Distribution.** Known from eastern North America: Manitoba, Ontario, Quebec, New Brunswick, and Nova Scotia south through Michigan, Indiana, Kentucky, New York, New Hampshire, Massachusetts, Pennsylvania, Maryland, Virginia, North Carolina, Georgia, and Florida (Pennsylvania record from Melander (1965)).

**Remarks.** The wings appear to be slightly shortened (i.e., approximately 1.5X the length of head + thorax) in a few female specimens of *B. pleuritica*. The length of vein  $R_{2+3}$  is also variable, generally being abbreviated and present as a short spur (Fig. 1), but occasionally completely absent. Rarely vein  $R_{2+3}$  is complete, as seen in a single female specimen of *B. pleuritica* from Brewster, Massachusetts and a series of four female specimens from Bradenton, Florida. In addition, there may be some variation in the extent of leg bristling in male specimens, where for example the apical row of short ventral setae on the fore tibia is not very conspicuous, although this may be due to a lack of pigmentation associated with preservation of teneral specimens.

## Discussion

*Baeodromia* belongs to the tachydromiine tribe Drapetini as defined by Sinclair and Cumming (2006), on the basis of the following apomorphies: eyes with ommatrichia, loss of  $CuA_2$  (inadvertently referred to as  $CuA_1$  by Sinclair and Cumming 2006, page 79), and loss of tergite 10 in females (correlated with sternite 10 positioned below the cerci). With the description of *Baeodromia* herein, the tribe currently includes 19 genera. The main phylogenetic patterns within Drapetini were discussed by Cumming and Cooper (1992) and a preliminary analysis of most of the included genera was attempted by Grootaert (1994), although precise relationships still need to be elucidated.

On the basis of the shared apomorphic shortening of the length of the basal radial (br) cell relative to the apex of the basal medial (bm) cell, *Baeodromia* appears related to a group of nine drapetine genera that comprises *Austrodrapetis* Smith, *Crossopalpus* Bigot, *Dusmetina* Gil, *Drapetis* Meigen, *Elaphropeza* Macquart, *Ngaheremyia* Plant and Didham, *Pontodromia* Grootaert, *Sinodrapetis* Yang, Gaimari and Grootaert, and *Stilpon* Loew. Conversely Grootaert (1994) and Plant and Didham (2006) consider *Austrodrapetis*, *Ngaheremyia*, and *Pontodromia* along with a few other genera, to belong to an Australasian-Melanesian clade of Drapetini, based on another shared venational character, the distal origin of the radial sector ( $R_s$ ) along  $R_1$ . However, this character state is sometimes difficult to code and based on conflicts with other characters, including the distinctly shortened cell

br, appears to have evolved more than once within Australasian–Melanesian drapetines.

The relationships within the hypothesized monophyletic group of nine genera mentioned above are still uncertain, although *Drapetis*, *Elaphropezia*, and *Crossopalpus* (and probably also the monotypic genera *Dusmetina* and *Sinodrapetis*) appear to form a clade (herein referred to as the *Drapetis* group) on the basis of similar male intersegmental gland–like modifications associated with abdominal terga 3–5, and the nearly universal presence of squamiform setae on some of these tergites in both the male and female. It is now known that similar male intersegmental gland–like modifications exist in some Oriental species of *Stilpon* (Shamshev and Grootaert 2004; Shamshev et al. 2006), so it is likely that this genus is related to the other five genera. *Austrodrapetis*, *Pontodromia*, and probably *Ngaheremyia* appear to represent another lineage (herein referred to as the *Austrodrapetis* group) within this group of nine genera, primarily on the basis of the distal origin of  $R_5$ . *Austrodrapetis* and *Pontodromia* are very similar and share a number of apomorphies, as indicated by Grootaert (1994). Interestingly like *Baeodromia*, *Austrodrapetis* also possesses lateral vessel–like glands in the male, but these are oriented differently, exiting along the anterior margin of the tergite rather than the posterior margin, and they occur under tergites 3 and 4 rather than tergite 2 (Smith 1964; Smith and Davies 1965). According to Grootaert (1994), *Pontodromia* does not possess lateral vessel–like glands in the male. A single median vessel–like gland also occurs in males of few species of the unrelated drapetine genus *Nanodromia* Grootaert (Grootaert and Shamshev 2003).

The exact relationship of *Baeodromia* to these three lineages (i.e., *Drapetis* group, *Stilpon*, and *Austrodrapetis* group) is presently uncertain. Although the genus shares two characters (i.e., a dorsoapical arista–like stylus and eyes contiguous on the face) with *Stilpon*, both features have developed independently numerous times within the Tachydromiinae. Homoplasy in the dorsoapical arista in particular, is very frequent in tachydromiine genera, such as *Stilpon* and *Baeodromia* that tend to be of very small body size. Although generic relationships of *Baeodromia* are unsure, the separate status and monophyly of the genus is substantiated by the apomorphic form of the arista, contiguous eyes on the face, unique form of the male abdominal glands, and the female terminalia with segment 8 fused into a ring. Further study of additional characters, such as the male abdominal glands, will hopefully improve our knowledge of the phylogenetic relationships within the Drapetini, allowing for a more precise placement of *Baeodromia*.

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## References

- Cumming, J. M. and B. E. Cooper. 1992. A revision of the Nearctic species of the tachydromiine fly genus *Stilpon* Loew (Diptera: Empidoidea). *The Canadian Entomologist* 124: 951-998.
- Cumming, J. M., B. J. Sinclair, and D. M. Wood. 1995. Homology and phylogenetic implications of male genitalia in Diptera—Eremoneura. *Entomologica Scandinavica* 26: 121-151.
- Cumming, J.M. and B.J. Sinclair. *In press*. Empididae (dance flies, balloon flies, predaceous flies). *In* Manual of Central American Diptera, Volume 1. B.V. Brown et al. (eds.), NRC Research Press, Ottawa.
- Grootaert, P. 1994. Two new genera of empidoid flies (Diptera, Empidoidea, Hybotidae, Tachydromiinae) from Melanesia. *Studia dipterologica* 1: 141-156.
- Grootaert, P. and I. V. Shamshev. 2003. New species of the genus *Nanodromia* Grootaert (Diptera, Empidoidea, Hybotidae) from Thailand. *The Natural History Journal of Chulalongkorn University* 3: 41-52.
- McAlpine, J. F. 1981. Morphology and Terminology—Adults [Chapter] 2. pp. 9-63, *In* Manual of Nearctic Diptera, Volume 1. Agriculture Canada Monograph, J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood (Coords.), 27, vi + 674 pp.
- Melander, A. L. 1928. Diptera, Fam. Empididae. *In* Genera Insectorum. P. Wytzman (ed.), 185 (1927): 1-434.
- Melander, A. L. 1965. Family Empididae (Empidae, Hybotidae). pp. 446-481, *In* A catalog of the Diptera of America north of Mexico. A. Stone, C. W. Sabrosky, W. W. Wirth, R. E. Foote, and J. R. Coulson (eds.), United States Department of Agriculture, Agricultural Research Service, Agriculture Handbook 276: iv + 1696 pp.
- O'Hara, J. E. 1983. Classification, phylogeny and zoogeography of the North American species of *Siphona* Meigen (Diptera: Tachinidae). *Quaestiones Entomologica* 18 (1982): 261-380.
- Plant, A. R. and R. K. Didham. 2006. A new genus of Drapetini (Diptera: Hybotidae: Tachydromiinae) from New Zealand. *Entomologist's Monthly Magazine* 142: 41-47.
- Shamshev, I. V. and P. Grootaert. 2004. A review of the genus *Stilpon* Loew, 1859 (Empidoidea: Hybotidae) from the Oriental region. *The Raffles Bulletin of Zoology* 52: 315-346.
- Shamshev, I. V., P. Grootaert, and A. Stark. 2006. Notes on a remarkable abdominal structure in some *Crossopalpus* Bigot species (Diptera: Hybotidae) with records from Southeast Asia. *Studia dipterologica* 12 (2005): 331-336.
- Sinclair, B. J. 2000. [Chapter] 1.2. Morphology and terminology of Diptera male terminalia. pp. 53-74 *In* Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance), Volume 1. General and Applied Dipterology. L. Papp and B. Darvas (eds.), Science Herald, Budapest, 978 pp.
- Sinclair, B. J. and J. M. Cumming. 2006. The morphology, higher-level phylogeny and classification of the Empidoidea (Diptera). *Zootaxa* 1180: 1-172.

- Smith, K. G. V. 1964. A remarkable new genus and two new species of Empididae (Tachydromiinae, Drapetini) from the Cook Islands. *Pacific Insects* 6(2): 247-251.
- Smith, K. G. V. and R. G. Davies. 1965. Gland-like abdominal structures of possible epigamic function in the Diptera. *Nature* 207: 321-322.



## REVISION OF THE NEOTROPICAL GENUS *TRACHAGATHIS* VIERECK (HYMENOPTERA: BRACONIDAE: AGATHIDINAE)

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### Abstract

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Two new species of *Trachagathis* Viereck are described and two species are synonymized under *Trachagathis rubricincta* (Ashmead). The generic limits of the genus are expanded to include species that do not have an elongate gena.

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### Introduction

Viereck (1913) proposed the genus *Trachagathis* with *T. taeniogaster* Viereck as the only included species, based on one specimen from Paraguay. Sharkey (2006a) discussed the phylogenetic position of *Trachagathis* and presented evidence for a monophyletic *Trachagathis* including the type species plus two additional species, *Agathis rubricincta* (Ashmead, in Riley et al. 1894), and *Agathis depressifrons* (Braet and van Achterberg 2003), which were transferred to *Trachagathis* as part of his redefinition of the genus. All of the above species are here treated as *Trachagathis rubricincta*, and two additional species of *Trachagathis* are described as new. All three species in the genus are neotropical and appear to be uncommon. Terminology follows Sharkey and Wharton (1997).

### Systematics

*Trachagathis* Viereck, 1913

**Type species:** *Trachagathis taeniogaster* Viereck, 1913

**Diagnosis.** Members of *Trachagathis* may be distinguished from all other agathidines by the presence of a groove running from the lateral ocellus anterolaterally to the superior orbit of the compound eye (Figs. 1c, 2c); this is a unique structure within the Agathidinae (Sharkey 2006b). All species have extensive granulate sculpture on many parts of the body including the propodeum, hind coxa (Fig. 3b), and first metasomal median tergite. Sharkey (2006b) provides a key to the New World genera of Agathidinae.

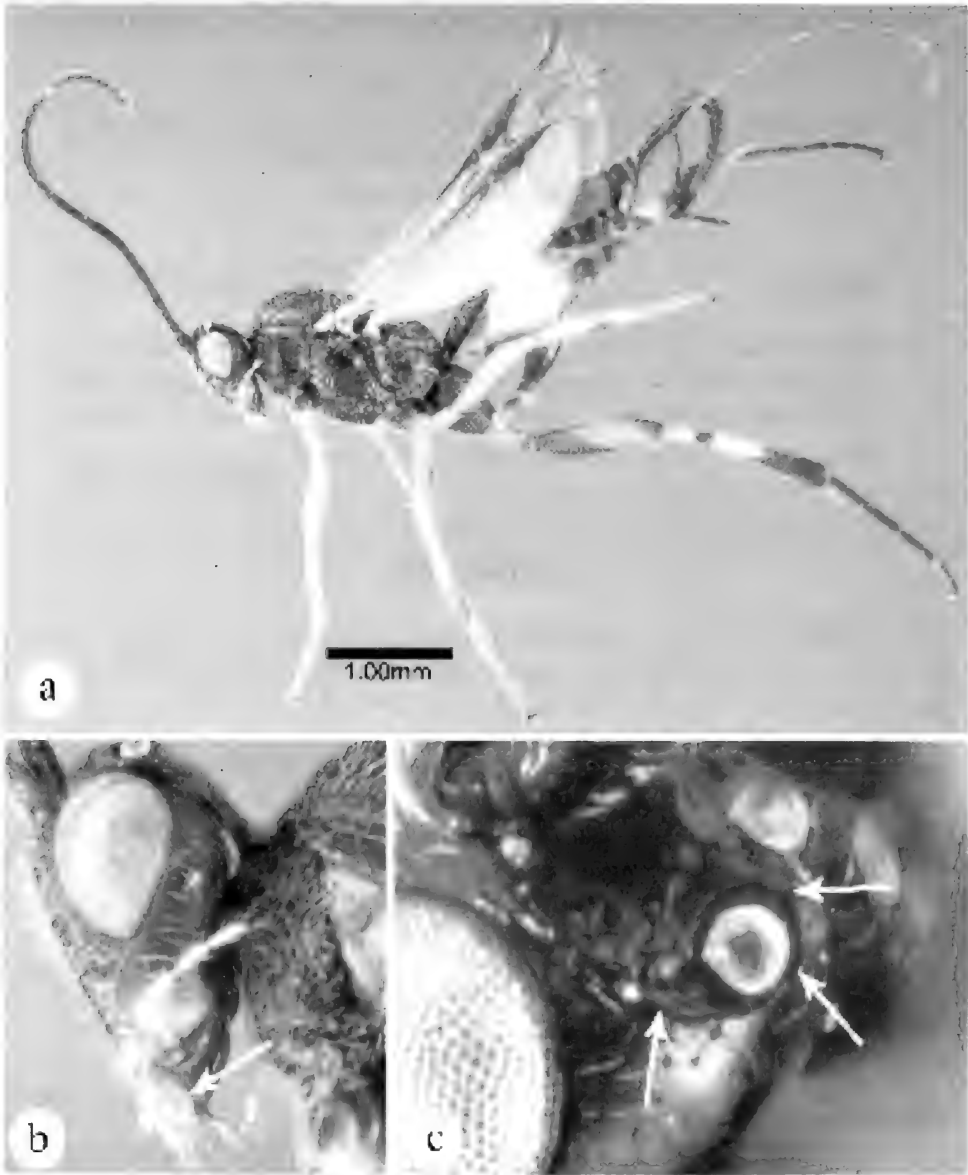


FIGURE 1. A) *Trachagathis pengellyella*, lateral habitus; B) *T. pengellyella*, head lateral aspect; arrow points to galea; C) *T. pengellyella*, detail of head, dorsolateral aspect, left arrow points to transverse groove, right arrows indicate that the medial margin of the groove is sharp.

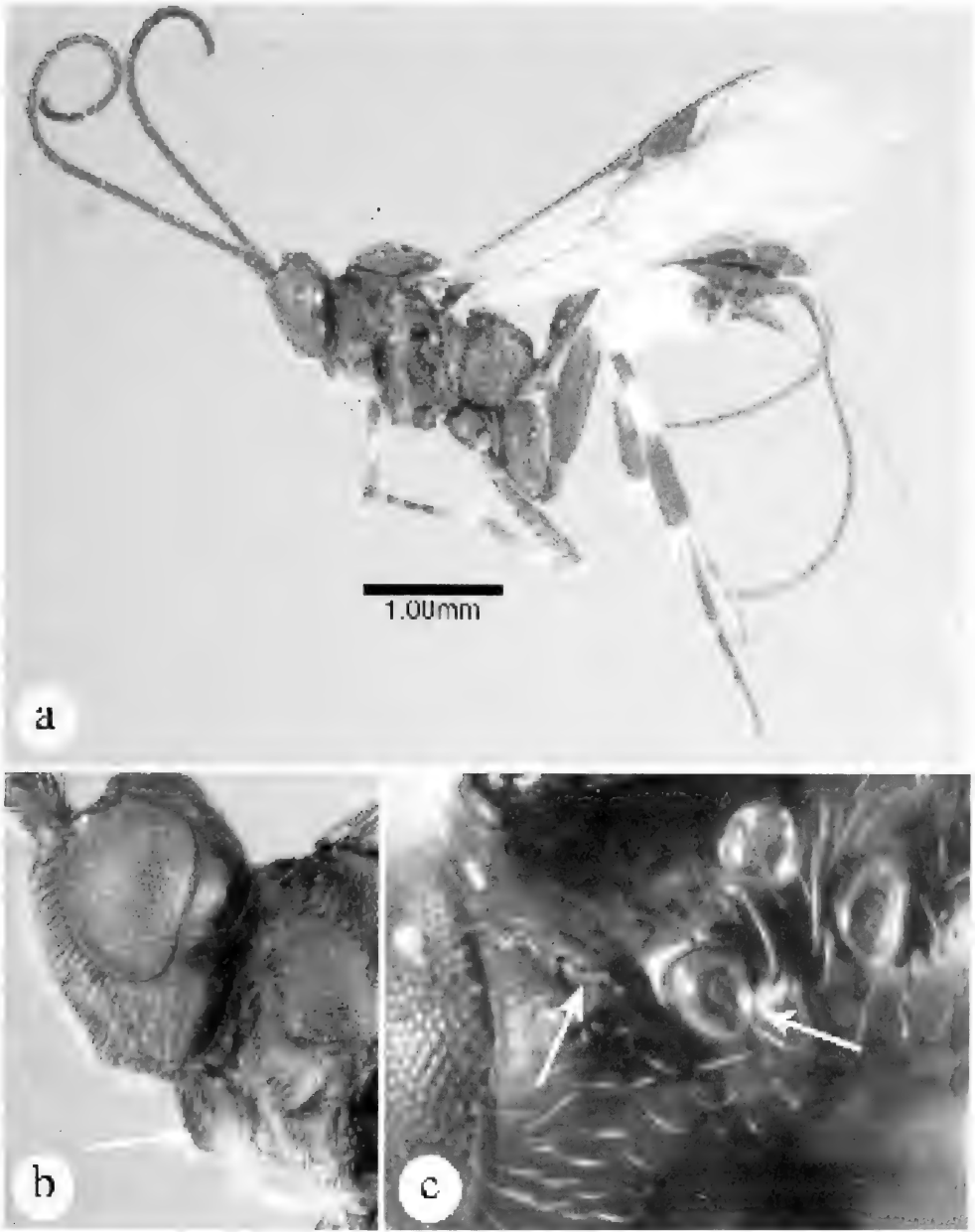


FIGURE 2. A) *Trachagathis townesiella*, lateral habitus; B) *T. townesiella*, head lateral aspect; arrow points to galea; C) *T. townesiella*, detail of head, dorsolateral aspect, left arrow points to transverse groove, right arrow indicates that the groove is not present medial to the ocellus.

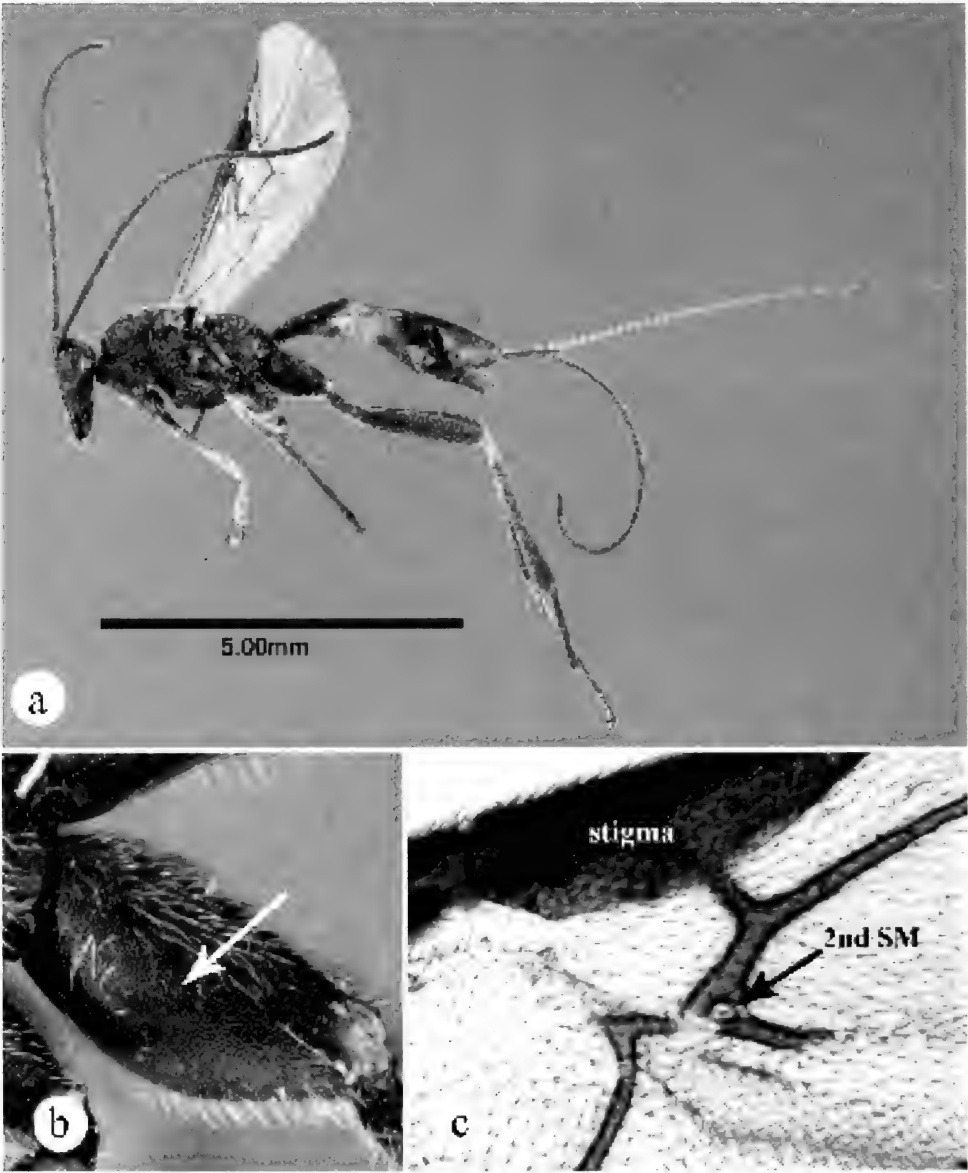


FIGURE 3. A) *Trachagathis rubricincta* lateral habitus; B) *T. rubricincta*, lateral surface of hind coxa showing granulate sculpture; C) *T. rubricincta*, detail of forewing showing small second submarginal cell (2<sup>nd</sup> SM).

**Description.** **Length:** 3.5-7.0 mm. **Head:** Number of flagellomeres 28-42; maxillary palpus 5-segmented, labial palpus 4-segmented, 3<sup>rd</sup> segment varying from subequal to 4<sup>th</sup> segment to about 1/5<sup>th</sup> the length of the 4<sup>th</sup> segment; longitudinal ridge running between the antennae; groove running from the medial margin of lateral ocellus anterolaterally to the superior orbit of the compound eye (Figs. 1c, 2c); gena not expanded, in the form of a flange, posteroventrally; galea elongate from slightly longer than wide to more than two times longer than wide. **Mesosoma:** Notauli impressed and foveolate; scutellum with posterior transverse ridge weakly indicated; propodeal sculpture variable, from entirely granulate, to entirely areolate rugose, often with a combination of the two sculptures; hind coxal cavities closed with a wide sclerite separating the coxal cavities and the metasomal foramen; metasomal foramen bordered ventrally by a high carina; propleuron lacking projection; sternaulus impressed and foveolate; second submarginal cell of forewing petiolate and very small (Figs. 3c, 4d); vein RS2b absent, RS+M absent; Cub of hind wing usually absent, rarely indicated as a stub in large specimens; foretibia lacking spines; midtibia with preapical and usually with apical spines; hind tibia with apical spines; all tarsal claws with truncate basal lobe; row of pectination visible on basal lobe of some specimens. **Metasoma:** 1<sup>st</sup> median tergite granulate, lacking longitudinal carinae; 2<sup>nd</sup> median tergite granulate, but sculpture weaker than that of 1<sup>st</sup>; ovipositor length subequal to body length. **Colour** (Figs. 1a, 2a, 3a): All three species are predominantly black except 2<sup>nd</sup> metasomal tergum pale yellow some lighter colour on the legs, including one or two light bands on hind tibia (Figs. 4a-c) and sometimes lighter colour on the mouthparts, lower gena, and posterior orbit; wings hyaline.

**Biology.** Sharkey (2006a) reported *Elasmopalpus lignosellus* (Zeller), the lesser cornstalk borer, as a host for *Trachagathis rubricincta*.

**Comments.** As mentioned in Sharkey (2006a), *Trachagathis* is probably a derived clade of the *cinctus* group of species that is presently placed in the polyphyletic genus *Bassus*. As shown in Sharkey et al. (2006) all members of Agathidinae other than members of Disophrini and Cremnoptini would have to be transferred to *Bassus* to render it monophyletic. For the sake of nomenclatorial stability it seems better to maintain the polyphyletic concept until a more in depth study is undertaken. Members of *Trachagathis* and the *cinctus* group share granulate sculpture which is otherwise rare in the subfamily. Transferring members of the *cintus* group to *Trachagathis* is also premature since this character state is the only evidence of monophyly. Hopefully molecular evidence, which is not yet available for *Trachagathis*, will clarify its phylogenetic position. In the original description of the genus (Viereck 1913) and in Sharkey's (1997) key, the groove running between the lateral ocellus and the superior orbit of the eye was referred to as a carina; I here follow Braet and van Achterberg (2003) in referring to it as a groove.

**Distribution:** Although known from only a total of about 85 specimens, *Trachagathis* appears to be widely distributed in South America east of the Andes from the Guyanas to northern Argentina. *Trachagathis rubricincta* also occurs in the Caribbean on both the Lesser and Greater Antilles, but since it has a host associated with corn and sugarcane (Sharkey 2006a), this distribution may have been influenced by agricultural trade.

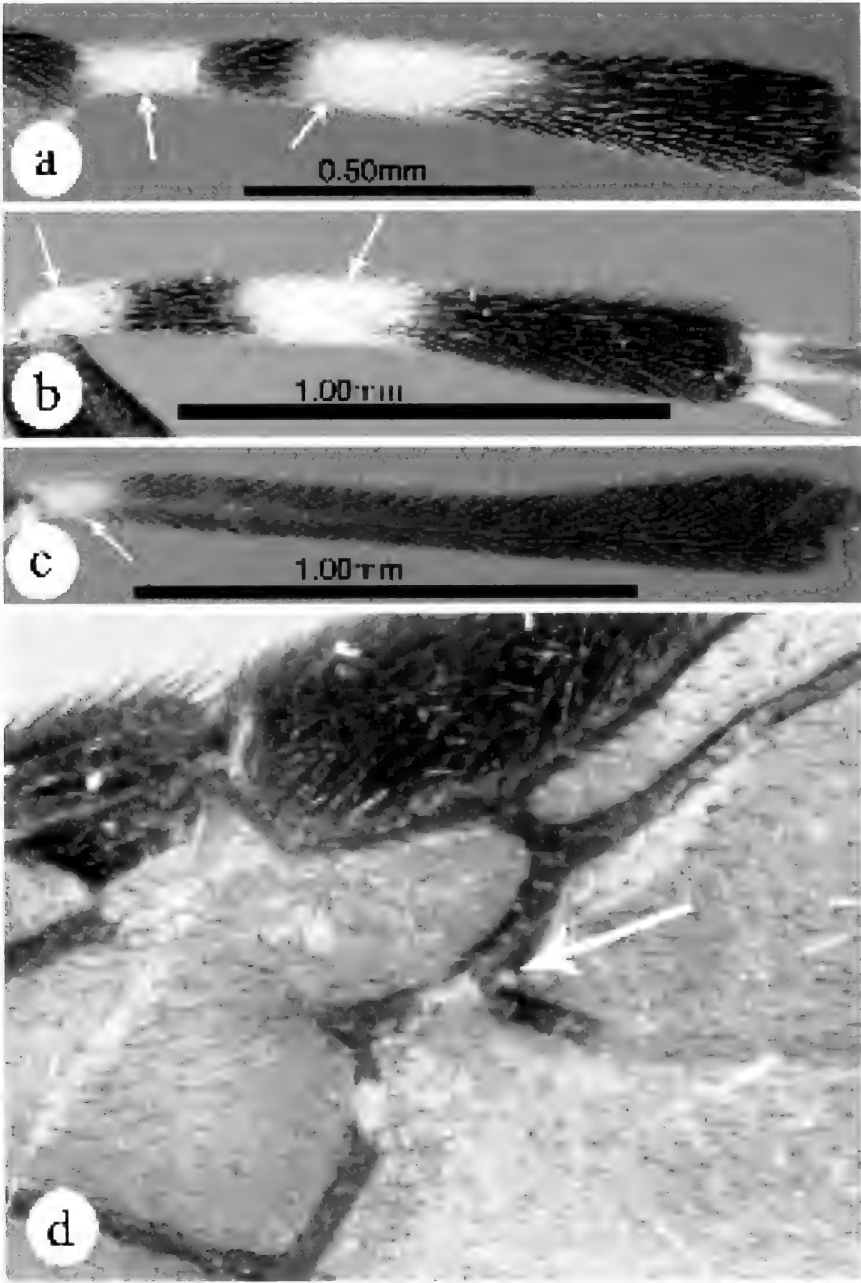


FIGURE 4. A) *Trachagathis pengellyella*, hind tibia illustrating colour pattern; B) *Trachagathis townesiella*, hind tibia illustrating colour pattern; C) *Trachagathis rubricincta*, hind tibia illustrating colour pattern; D) *Trachagathis rubricincta*, detail of forewing of holotype of *Agathis depressifrons*.

### Key to species of *Trachagathis*

- 1 Hind tibia with single pale band, positioned basally (Fig. 4c) ..... *T. rubricincta* (Ashmead)
- Hind tibia with two pale bands, one basally and one near midlength (Figs. 4a, b) ..... 2
- 2 Transverse groove on frons only extending to lateral margin of lateral ocellus (Fig. 2c); mid femur melanic ..... *T. townesiella* n.sp.
- Transverse groove on frons extending to medial side of lateral ocellus (Fig. 1c); mid femur yellow ..... *T. pengellyella* n.sp.

### Species Treatments

Note: In the species descriptions, variation for continuous and meristic characters is given in parentheses.

#### *Trachagathis rubricincta* (Ashmead) (Figs. 3a-c, 4c-d)

*Agathis rubricincta* Ashmead, 1894 (Holotype examined)

*Trachagathis rubricincta*, Sharkey 2006a

*Trachagathis taeniogaster* Viereck 1913 **N. Syn.** (Holotype examined)

*Agathis depressifrons* Braet and van Achterberg, 2003. **N. Syn.** (Holotype examined)

*Trachagathis depressifrons*, Sharkey 2006a

**Diagnosis.** Hind leg melanic except for a pale band at extreme base (Fig. 4c); galea more elongate than other species, clearly longer than wide (Fig. 3a).

**Description. Holotype Female. Length:** 5.23 mm (3.82-6.48) **Head:** Antenna with 37 (35-42) flagellomeres; penultimate labial palpomere subequal in length to apical palpomere; galea elongate, clearly longer than wide (Fig. 3a); malar space long, 0.74x eye height; groove between lateral ocellus and compound eye deeply excavated; sharp medial margin of groove extending past medial margin of lateral ocellus (c.f., Fig. 1c). **Mesosoma:** mesoscutum with deep irregular punctures; notauli crenulate and deeply impressed; median areola of metanotum rounded, rugose and irregular apically, propodeum with granulate microsculpture and some with areolate rugose macrosculpture, pronotum granulate with some rugose sculpture; mesopleuron with deep irregular punctures over much of surface, often granulate posteriorly; sternaulus deep and crenulate; metapleuron granulate; second submarginal cell of forewing small (Fig. 3c); Cub vein of hind wing represented by a small bulge on cu-a. **Metasoma:** 1<sup>st</sup> median tergite granular with small longitudinal rugosities anterolaterally; 2<sup>nd</sup> median tergite weakly granulate, 3<sup>rd</sup> median tergite weakly granulate anteriorly becoming smooth posteriorly; remainder of metasoma smooth; ovipositor slightly longer than body length. **Colour** (Fig. 3a): Black except yellow or yellowish brown as follows: some mouthparts, posterior orbit of eye, fore and middle legs apical to the basal 3<sup>rd</sup> of the femora, extreme base of hind tibia; 2<sup>nd</sup> metasomal segment and parts of sterna, and laterotergites of 1<sup>st</sup> and 3<sup>rd</sup> metasomal segments.

**Males.** Only 4 of the 67 specimens examined were males. Except for sexual characters they are very similar to females. All of the males are rather small, the smallest specimen is a male with a body length of 3.68 mm.

**Biology.** Two rearings from the Commonwealth Institute of Biological Control in the Caribbean resulted in host records from the lesser cornstalk borer, *Elasmopalpus lignosellus* (Zeller). One of the hosts was reared from sugarcane and it is likely that they both were, though one specimen lacks this detailed label data. Full data for these specimens is given in Sharkey (2006a).

**Variation and Comments.** The specimens here treated as *T. rubricincta* vary significantly in body length. Specimens from the eastern and southern Amazon basin are particularly large. I have looked carefully at these specimens for other characters that might suggest separate species status, but could find none. The second submarginal cell of all specimens is very small, especially so in the holotype of *Agathis depressifrons* (Fig. 4d) where it is little more than an indentation at the point where veins 2RS and M meet. However there is continuous variation from this size to that of Figure 3c, which is the most common for the species.

**Distribution.** Widespread in the Caribbean, and recorded from the following South American countries: Argentina (Tucumán), Brazil, Peru, Bolivia, and French Guyana.

**Type Material Examined. Holotype Female:** *Agathis rubricincta* Ashmead, "Windward Side, St. Vincent, W.I." [West Indies], British Museum (Natural History). **Holotype Female:** *Trachagathis taeniogaster* Viereck, "Paraguay (San Bernadino) K. Fiebrig, S.V., 19\_\_iv [sic.], Type" Museum für Naturkunde der Humboldt-Universität, Berlin, Germany. **Holotype Female:** *Agathis depressifrons* Braet and Achterberg "Guyane française: Sinnamary, Pointe Combi, 2-9-xi.2000, Malaise trap, 5°18'N- 52°57'W, P. Cerdan [sic = Cerda] - lab Hydrobiologie", Nationaal Natuurhistorisch Museum, Leiden, Netherlands.

***Trachagathis townesiella* Sharkey new species (Figs. 2a-c, 4b)**

**Diagnosis.** Hind leg melanic except for 2 white bands (Fig. 4b), one at the extreme base and one just basal to the mid-point; transverse groove on frons only extending to lateral margin of lateral ocellus (Fig. 2c).

**Description. Holotype Female. Length:** 4.00 mm (3.85-4.12). **Head:** Antenna with 33 (32-33) flagellomeres; penultimate labial palpomere slightly more than half as long as apical palpomere; galea moderately elongate, clearly longer than wide; malar space not elongate (Fig. 2b), 0.45x eye height; groove between lateral ocellus and compound eye weakly excavated; medial margin of groove ending on lateral margin of lateral ocellus (Fig. 2c). **Mesosoma:** Mesoscutum with irregular punctures; notauli deeply impressed, smooth, or with a few weak crenulae; median areola of metanotum truncate apically; propodeum densely areolate rugose, areolae with smaller rugosities; mesopleuron with shallow irregular

punctures over much of surface, often granulate posteriorly; sternaulus deep and crenulate; pronotum granulate; mesopleuron with small scattered punctures; sternaulus deep and crenulate; metapleuron granulate; second submarginal cell of forewing small (c.f., Fig. 3c); Cub vein of hind wing usually absent (represented by short stub in some specimens). **Metasoma:** 1<sup>st</sup> median tergite granular with small longitudinal rugosities anterolaterally; 2<sup>nd</sup> median tergite weakly granulate, 3<sup>rd</sup> median tergite from entirely smooth to weakly granulate anteriorly becoming smooth posteriorly; remainder of metasoma smooth; ovipositor slightly shorter than body length. **Colour** (Fig. 2a): Black except as follows: palpi and some other mouthparts yellow, foreleg dark basally gradually lightening in colour distally, foretibia and tarsus yellow; middle leg except coxa brownish yellow, with a weak light band on tibia; hind tibia with 2 light bands, one basal and another ending at midlength (Fig. 4b); 2<sup>nd</sup> metasomal segment and sterna and laterotergite of 1<sup>st</sup> metasomal segment yellow (Fig. 3a).

**Males.** Unknown.

**Biology.** Unknown.

**Distribution.** Atlantic rainforest of southeastern Brazil.

**Etymology.** Named in honor of Marjorie Townes and the late Henry Townes who collected most of the specimens.

**Type Material.** **Holotype** ♀, **BRAZIL:** [Rio de Janeiro State], Teresopolis, [22°25'60" S, 42°58'60"W, 1068 m.], 14 March 1966, H. & M. Townes (American Entomological Institute). **Paratypes:** **BRAZIL:** Rio de Janeiro State: ♀, Serra da Bocaina, [23°13'0" S, 44°43'0"W], F. M. Oliveira, (American Entomological Institute). Parana: 2♀, Quatro Barros [sic.] (= Barras), [25°22'0"S, 49°4'60"W, 904m.], 5-9 February 1966, H. & M. Townes (American Entomological Institute). ♀, Campina Grande nr. Curitiba, [25°18'0"S, 49°4'60"W, 914 m.], 23 February 1966, H. & M. Townes (American Entomological Institute).

*Trachagathis pengellyella* Sharkey new species (Figs. 1a-c, 4a)

**Diagnosis.** Hind femur yellow in apical half, hind tibia with 2 white bands, one at the extreme base and one just basal to the mid-point; transverse groove on frons extending to medial side of lateral ocellus (Fig. 1c).

**Description.** **Holotype Female.** **Length:** 4.03 mm (3.58-4.20). **Head:** Antenna with 29 (28-30) flagellomeres; penultimate labial palpomere slightly less than half as long as apical palpomere; galea short, unmodified, slightly longer than wide (Fig. 1b); malar space not elongate 0.47x eye height; groove between lateral ocellus and compound eye deeply excavated; sharp medial margin of groove mesad lateral ocellus. **Mesosoma:** mesoscutum with irregular punctures; notauli deeply impressed, crenulate; median areola of metanotum acute to rounded apically; propodeum densely areolate rugose, areolae with smaller

rugosities or granulations; pronotum rugose anteroventrally, smooth to weakly granulate posterodorsally; mesopleuron with small scattered punctures, granulate posteriorly; sternaulus deep and crenulate; metapleuron smooth to weakly rugose with a hint of granulate microsculpture; second submarginal cell of forewing small (c.f., Fig. 3c) [barely indicated in the specimen from Nova Teutonia (c.f. Fig. 4d)]; Cub vein of hind wing absent. **Metasoma:** 1<sup>st</sup> median tergite granular with small longitudinal rugosities anterolaterally; 2<sup>nd</sup> median tergite weakly granulate, 3<sup>rd</sup> median tergite smooth; remainder of metasoma smooth; ovipositor slightly shorter than body length. **Colour** (Fig. 1a): Black except as follows: palpi and some mouthparts yellow; all legs except coxae yellow or yellowish brown; middle leg with two weak light bands on tibia, a small one at base and one occupying most of surface except for apex; hind tibia with 2 light bands, one basal and another ending just past midlength (Fig. 4a); 2<sup>nd</sup> metasomal segment and sterna and laterotergite of 1<sup>st</sup> metasomal segment yellow.

**Males.** Unknown.

**Biology.** Unknown.

**Distribution.** Tucumán, Argentina, and Nova Teutonia, Brazil.

**Etymology.** Named in honor David Pengelly whose kindheartedness and gentle encouragement helped me through pivotal years of my university education.

**Type Material. Holotype Female. ARGENTINA:** Tucumán, San Pedro Colalao, [26°13'60"S, 65°28'60"W, 1056 m.], 1-11 September 1968. L. Stange, (American Entomological Institute). **Paratypes: ARGENTINA:** Tucumán: ♀, same data as holotype except 8 November–8 December 1967, (American Entomological Institute). ♀, Tacanas, [27°7'60"S, 64°49'0"W, 356 m.], 7-17 December 1968, L. Stange, (American Entomological Institute). ♀, Rio Nio [sic = Río del Nío], [26°25'60"S, 64°55'60"W, 886 m.], 30 November 1964, C. C. Porter, (Museum of Comparative Zoology, Harvard). **BRAZIL:** ♀, Nova Teutonia, 27°11'8"S, 52°23'1"W, 300-500 m., 13 February 1969, F. Plaumann, (Canadian National Collection, Ottawa).

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## References

- Braet, Y. and C. van Achterberg. 2003. *Doryctorgilus* gen. nov. and other new taxa, with a study of the internal microsculpture of the ovipositor in the subfamily Orgilinae Ashmead (Hymenoptera: Braconidae). *Zoologische Mededelingen (Leiden)* 77(6): 127-152.
- Riley, C. V., W. H. Ashmead, and L. O. Howard. 1894. Report upon the parasitic Hymenoptera of the island of St. Vincent. *Linnean Society's Journal-Zoology* 25: 56-254.
- Sharkey, M. J. 1997. Subfamily Agathidinae, pp.69-84. *In* Manual of the New World genera of Braconidae (Hymenoptera). Wharton, R. A., P. M. Marsh, and M. J. Sharkey (eds.), Special Publication of the International Society of Hymenopterists. vol. 1: 1-439 pp.
- Sharkey, M. J. 2006a. Review of the systematics of *Trachagathis* Viereck (Hymenoptera: Braconidae: Agathidinae). *Zootaxa* 1162: 65-68.
- Sharkey, M. J. 2006b. Two new genera of Agathidinae (Hymenoptera: Braconidae) with a key to the genera of the New World. *Zootaxa* 1185: 37-51.
- Sharkey, M. J., N. M. Laurenne, B. Sharanowski, D. L. J. Quicke, and D. Murray. 2006. Revision of the Agathidinae (Hymenoptera: Braconidae) with comparisons of static and dynamic alignments. *Cladistics* 22:546-567.
- Sharkey, M. J. and R. A. Wharton. 1997. Morphology and terminology. pp. 19-38 *In* Manual of the New World genera of the family Braconidae. Wharton R.A., P.M. Marsh, and M. J. Sharkey (eds.), Special Publication of the International Society of Hymenopterists, Number 1, Washington D. C.
- Viereck, H. L. 1913. Descriptions of twenty-three new genera and thirty-one new species of Ichneumon-flies. *Proceedings of the United States National Museum* 46:359-386.

1. The first part of the paper is devoted to a general discussion of the problem of the existence of solutions of the system of equations

$$\frac{dx}{dt} = f(x, y, z), \quad \frac{dy}{dt} = g(x, y, z), \quad \frac{dz}{dt} = h(x, y, z),$$

where  $f, g, h$  are continuous functions of  $x, y, z$ .

2. In the second part we consider the case when the functions  $f, g, h$  are linear in  $x, y, z$ .

3. In the third part we consider the case when the functions  $f, g, h$  are quadratic in  $x, y, z$ .

4. In the fourth part we consider the case when the functions  $f, g, h$  are cubic in  $x, y, z$ .

5. In the fifth part we consider the case when the functions  $f, g, h$  are quartic in  $x, y, z$ .

6. In the sixth part we consider the case when the functions  $f, g, h$  are quintic in  $x, y, z$ .

7. In the seventh part we consider the case when the functions  $f, g, h$  are sextic in  $x, y, z$ .

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13. In the thirteenth part we consider the case when the functions  $f, g, h$  are duodecic in  $x, y, z$ .

14. In the fourteenth part we consider the case when the functions  $f, g, h$  are tridecic in  $x, y, z$ .

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16. In the sixteenth part we consider the case when the functions  $f, g, h$  are quindecic in  $x, y, z$ .

17. In the seventeenth part we consider the case when the functions  $f, g, h$  are sexdecic in  $x, y, z$ .

18. In the eighteenth part we consider the case when the functions  $f, g, h$  are septendecic in  $x, y, z$ .

19. In the nineteenth part we consider the case when the functions  $f, g, h$  are octodecic in  $x, y, z$ .

20. In the twentieth part we consider the case when the functions  $f, g, h$  are novendecic in  $x, y, z$ .

21. In the twenty-first part we consider the case when the functions  $f, g, h$  are duodeviginti in  $x, y, z$ .

22. In the twenty-second part we consider the case when the functions  $f, g, h$  are tredeciginti in  $x, y, z$ .

23. In the twenty-third part we consider the case when the functions  $f, g, h$  are quattuordeciginti in  $x, y, z$ .

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25. In the twenty-fifth part we consider the case when the functions  $f, g, h$  are sexdeciginti in  $x, y, z$ .

26. In the twenty-sixth part we consider the case when the functions  $f, g, h$  are septendeciginti in  $x, y, z$ .

27. In the twenty-seventh part we consider the case when the functions  $f, g, h$  are octodeciginti in  $x, y, z$ .

28. In the twenty-eighth part we consider the case when the functions  $f, g, h$  are novendeciginti in  $x, y, z$ .

29. In the twenty-ninth part we consider the case when the functions  $f, g, h$  are duodeviginti in  $x, y, z$ .

30. In the thirtieth part we consider the case when the functions  $f, g, h$  are tredeciginti in  $x, y, z$ .

31. In the thirty-first part we consider the case when the functions  $f, g, h$  are quattuordeciginti in  $x, y, z$ .

32. In the thirty-second part we consider the case when the functions  $f, g, h$  are quindeciginti in  $x, y, z$ .

33. In the thirty-third part we consider the case when the functions  $f, g, h$  are sexdeciginti in  $x, y, z$ .

34. In the thirty-fourth part we consider the case when the functions  $f, g, h$  are septendeciginti in  $x, y, z$ .

35. In the thirty-fifth part we consider the case when the functions  $f, g, h$  are octodeciginti in  $x, y, z$ .

36. In the thirty-sixth part we consider the case when the functions  $f, g, h$  are novendeciginti in  $x, y, z$ .

37. In the thirty-seventh part we consider the case when the functions  $f, g, h$  are duodeviginti in  $x, y, z$ .

38. In the thirty-eighth part we consider the case when the functions  $f, g, h$  are tredeciginti in  $x, y, z$ .

39. In the thirty-ninth part we consider the case when the functions  $f, g, h$  are quattuordeciginti in  $x, y, z$ .

40. In the fortieth part we consider the case when the functions  $f, g, h$  are quindeciginti in  $x, y, z$ .

## REVIEW OF THE CANADIAN SPECIES OF *HOPLISOIDES* (HYMENOPTERA: CRABRONIDAE) WITH REVISIONARY NOTES ON THE *H. PLACIDUS* SPECIES GROUP

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### Abstract

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The seven Canadian species of *Hoplisoides* Gribodo are reviewed and a key to species is presented. Three species are recorded for the first time from Canada: *H. hamatus* (Handlirsch), *H. punctifrons* (Cameron), and *H. tricolor* (Cresson). Characters of the flagellum are used for the first time to distinguish the very similar males of the *H. placidus* species group. *Hoplisoides nebulosus* (Packard) sp. restit., formerly considered a subspecies of *H. placidus* (Smith), is reinstated as a good species. *Hoplisoides spilopterus* (Handlirsch) is reduced to subspecies rank: *H. nebulosus spilopterus* stat. nov.. *Gorytes pergandei* Handlirsch is removed from synonymy with *Hoplisoides nebulosus* and given subspecies rank as *H. placidus pergandei* stat. nov.. *Gorytes microcephalus* Handlirsch is removed from synonymy with *H. nebulosus* and synonymized with *H. placidus pergandei*. *Hoplisoides birkmanni* Baker (from southcentral U.S.) and its synonym *H. pruinosus* Baker are also removed from synonymy with *H. nebulosus* and the former is reinstated as a valid subspecies: *H. placidus birkmanni* ssp. restit.. A neotype for *Philanthus harringtonii* Provancher (synonym of *H. nebulosus*) and lectotypes for *Gorytes pergandei* and *G. microcephalus* are designated.

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### Introduction

Recent work on spheciform wasps in Ontario (Buck 2004) led to the discovery that two eastern Nearctic species of *Hoplisoides* Gribodo were previously confused under the name *H. placidus nebulosus* (Packard). This realisation made necessary several taxonomic changes in the *H. placidus* species group including the designation of lectotypes and a neotype. These findings and three new species records for Canada are presented within the framework of a review of the Canadian species of the genus.

The Nearctic, Central American, and Caribbean species of *Hoplisoides* were reviewed and keyed by Bohart (1997). Bohart's key is the only available recent key for Nearctic *Hoplisoides* but is difficult to use for males of some species of the *H. placidus* group. The *H. placidus* group was defined by Bohart and Menke (1976) based on the absence of woolly hair on male sterna 4-5 and a large anteroventral metapleural pit. It

includes four species in Canada: *H. placidus*, *H. nebulosus*, *H. punctifrons*, and *H. hamatus*. The present study revealed new diagnostic characters in the male flagellum such as the shape of the tyloid of male flagellomere I and the microtomentum of flagellomere XI. The wing pattern is diagnostic in both sexes but shows strong sexual dimorphism in most species.

Wasps of the genus *Hoplisoides* are relatively rare in Canada and not particularly well represented in collections. These medium-sized, ground-nesting gorytine wasps usually prey on Membracidae and Cicadellidae, although extralimital species also take fulgoroid planthoppers. More or less detailed biological information is available on all Canadian species (e.g., Evans 1966) except *H. punctifrons* and *H. pygidialis*.

## Materials and Methods

Lists of synonymic names are only provided for taxa whose synonymies were revised; synonymies for other species can be found in Bohart (1997) or Pulawski (2006). Detailed specimen data is provided only for Canadian material and for specimens pertaining to revised taxa.

**Photography:** Photographs were taken with a Microptics Digital Lab XLT imaging system using a Canon EOS 1 Ds camera and Microptics ML-1000 flash fibre optic illumination system. Each image was assembled from a series of photographs (with different focal planes) using the computer freeware CombineZ (Hadley 2005).

**Abbreviations:** F (e.g., in FXI) – flagellomere; T (e.g., in T5) – tergum. Abbreviations for provinces and territories in Canada and for states in the United States are the same ones that are used by the postal system in both countries. Co. – County; Distr. – District; Reg. – Region.

**Acronyms of depositories:** ANSP – Academy of Natural Sciences, Philadelphia, Pennsylvania; BAR – private collection of Brad Arnal and Harold Duggan, Waterloo, Ontario; BCPM – Royal British Columbia Museum, Victoria, British Columbia; CASC – California Academy of Sciences, Dept. of Entomology, San Francisco, California; CNCI – Canadian National Collection of Insects, Ottawa, Ontario; CSUC – Colorado State University, Fort Collins, Colorado; DEBU – Dept. of Environmental Biology, University of Guelph, Guelph, Ontario; EDUM – J. B. Wallis Museum, Entomology Dept., University of Manitoba, Winnipeg, Manitoba; LPC – collection of Laurence Packer, York University, Toronto, Ontario; MHNG – Muséum d'Histoire Naturelle, Genève, Switzerland; PMAE – Royal Alberta Museum (formerly Provincial Museum of Alberta), Edmonton, Alberta; ROME – Royal Ontario Museum, Toronto, Ontario; SEMC – Snow Entomological Museum, University of Kansas, Lawrence, Kansas; ULQC – University of Laval, Dept. of Biology, Québec City, Québec; USNM – United States National Museum, Washington, D.C.

Specimens are deposited in the Guelph collection (DEBU) unless mentioned otherwise.

Genus *Hoplisoides* Gribodo

Key to the Canadian species of *Hoplisoides* Gribodo

Note: *H. confertus* (Fox), a species recorded from as far north as Montana, was included in the key because it could occur in Canada.

1. Lower metapleural pit much smaller than diameter of mid ocellus .....2
- Lower metapleural pit about as large as mid ocellus (Fig. 1) .....*H. placidus* group 5
2. Metapleuron gradually tapering from upper to lower pit. Mesosoma mostly red in female .....*H. tricolor* (Cresson)
- Metapleuron parallel-sided for most of its length below upper pit, fairly abruptly tapered near lower pit. Colour of mesosoma variable .....3
3. Female with scutum and mesopleuron mostly red, metasomal terga mostly yellow. Male sterna 3-5 with dense, white, woolly pubescence; sternum 5 on each side with a raised submarginal carina (western U.S.) .....[*H. confertus* (Fox)]
- Female scutum and mesopleuron mostly black, lacking red markings. Male sterna 3-5 with short, sparse, inconspicuous pubescence; sternum 5 without lateral carinae .....4

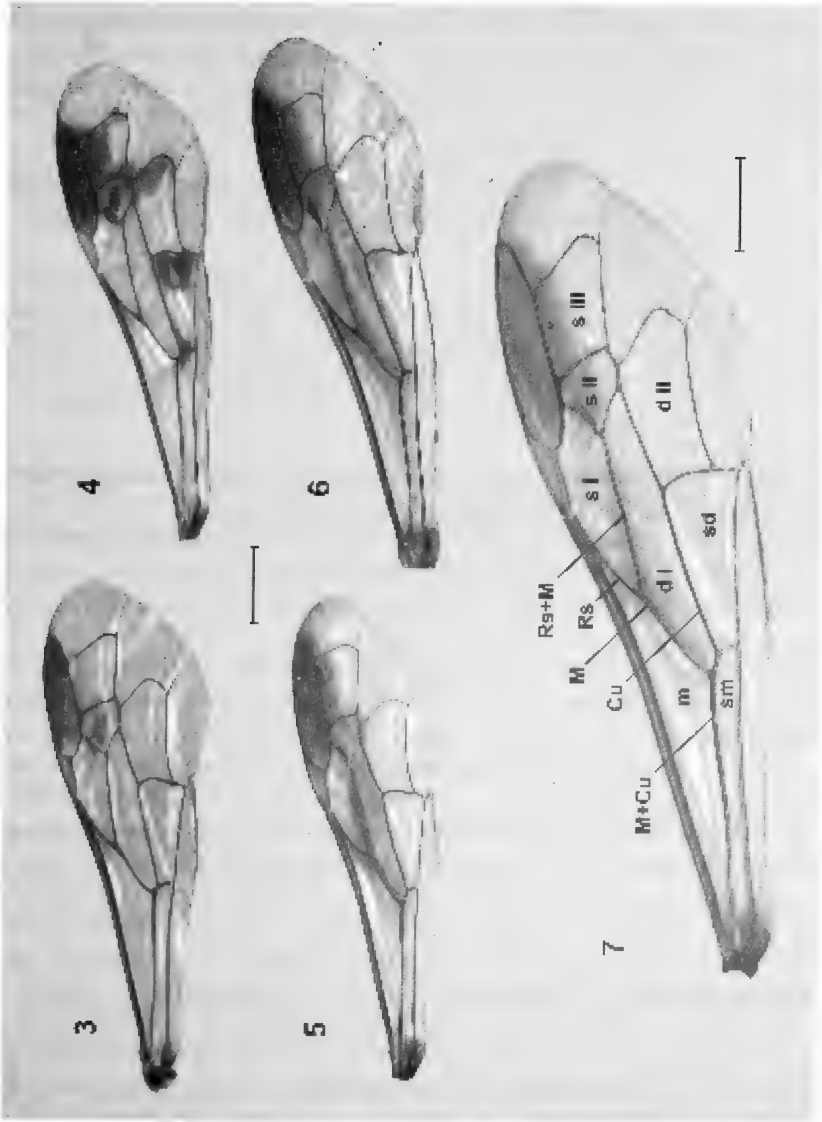


FIGURE 1. *Hoplisoides nebulosus nebulosus*, female habitus (Ontario, Windsor). Scale bar=1 mm. Abbreviation: p – lower metapleural pit.

4.	Terga 4-5 mostly yellow, female tergum 6 often partly yellow (western) .....	<i>H. pygidialis</i> (Fox)	
–	Terga 4-5 mostly black, only with narrow yellow apical fasciae, female tergum 6 black (eastern) .....	<i>H. costalis</i> (Cresson)	
5.	Male .....		6
–	Female .....		10
6.	Clypeus distinctly bevelled apically, bevel forming a $\leq 90^\circ$ angle with clypeal disc (Fig. 2). FI with very short, tubercle-like tyloid; FXI with bare ventral area (devoid of microtomentum). Lateral clypeal hair tufts conspicuously (almost semicircularly) curved medially. Yellow band of scutellum usually divided medially or incised anteriorly (western) .....	<i>H. hamatus</i> (Handlirsch)	
–	Clypeus not distinctly bevelled (apical margin forming a $> 90^\circ$ angle with clypeal disc), if slightly bevelled ( <i>H. punctifrons</i> ), then FI with linear tyloid that extends over most of length of flagellomere, and FXI without bare area (i.e., completely covered in microtomentum). Lateral clypeal hair tufts straight to moderately curved medially. Yellow band of scutellum entire except in some eastern specimens .....		7
7.	FI with linear tyloid that extends over most of length of flagellomere; FXI without bare area ventrally. Discoidal cell I, medial cell, and submarginal cell I (except small area contiguous to submarginal cell II) completely clear (as in Fig. 3) (western) .....	<i>H. punctifrons</i> (Cameron)	



FIGURE 2. *Hoplisoides hamatus*, male head (California, Davis, CASC). Scale bar=0.5 mm.



FIGURES 3-7. *Hoplisoides* spp., fore wings. 3 – *H. nebulosus nebulosus*, male (Ontario, Hepworth); 4 – ditto, female (Ontario, Windsor); 5 – *H. placidus pergandei*, male (Ontario, Brantford); 6 – ditto, female (Ontario, Christian I.); 7 – *H. pygidialis*, female (Alberta, Writing-on-Stone Provincial Park, PMAE). Scale bars=1 mm. Abbreviations: Cu, M, Rs: veins Cu, M, Rs; d I, II: discoidal cells I, II; m: medial cell; s I, II, III: submarginal cells I, II, III; sd: subdiscoidal cell; sm: submedian cell.

- First flagellomere with very short, tubercle-like tyloid. Last flagellomere with bare area ventrally; very small and inconspicuous in some eastern specimens (some *H. placidus pergandei*) but then discoidal cell I, distal portion of medial cell and posterior portion of submarginal cell I at least slightly infuscated.....8
- 8. Discoidal cell I, medial cell along Rs and M, and posterior portion of submarginal cell I slightly to moderately infuscated (Fig. 5). FXI completely microtomentose or with small bare area (smaller than lateral ocellus) .....*H. placidus pergandei* (Handlirsch)
- Discoidal cell I, medial cell (excl. area beyond fork of Rs and M), and submarginal cell I (except small area contiguous to submarginal cell II) completely clear (Fig. 3). FXI with larger bare area (at least as large as lateral ocellus) .....*H. nebulosus* (Packard) 9
- 9. Alberta and British Columbia south to western Texas, Chihuahua, and California. Tergum 5 with well-developed yellow apical fascia .....*H. n. spilopterus* (Handlirsch)
- Eastern Canada south to North Carolina and Tennessee, west to Kansas and Iowa. Tergum 5 usually without yellow apical fascia.....*H. n. nebulosus* (Packard)  
Note: Males of the two subspecies of *H. nebulosus* cannot always be separated based on the provided character. The geographic boundary between the subspecies is insufficiently known.
- 10. Subdiscoidal cell with anterior infuscation that extends all along Cu, clear posteriorly; no discrete infuscation in apical 2/5 (Fig. 6) (eastern) .....*H. placidus pergandei* (Handlirsch)  
Subdiscoidal cell with discrete infuscation in apical 2/5 (Fig. 4) .....11
- 11. Propodeum at least in part reddish. Metasomal tergum 1 and sometimes 2 in part reddish (western) .....12
- Ground colour of propodeum and terga black, lacking reddish markings .....13
- 12. Pronotum, scutum laterally and tergum 2 partially red; terga 3-5 entirely black or with narrow yellow apical fascia .....*H. punctifrons* (Cameron)
- Pronotum, scutum laterally and metasomal tergum 2 rarely with red areas but if so then terga 3-5 predominantly yellow .....*H. nebulosus spilopterus* (Handlirsch)
- 13. Transverse yellow band of scutellum medially divided or anteriorly incised. Punctures of apical third of tergum 1 small, distinctly smaller than those of tergum 2 (western) .....*H. hamatus* (Handlirsch)
- Transverse yellow band of scutellum entire, anterior margin sometimes slightly concave but not incised. Punctures of metasomal tergum 1 larger; largest ones subequal to those of tergum 2 (eastern) .....*H. nebulosus nebulosus* (Packard)

### ***H. placidus* species group**

**Diagnosis.** Lower metapleural pit about as large as mid ocellus.

***Hoplisoides nebulosus nebulosus* (Packard, 1867) sp. restit.** (Figs. 1, 3, 4)

*Gorytes nebulosus* Packard, 1867: 422 (♀).

*Gorytes armatus* Provancher, 1887: 272 (♂, erroneously stated as ♀). Bohart in Bohart and Menke 1976: 521 (synonymy).

*Philanthus harringtonii* Provancher 1888: 278 (♂, sex not indicated in description). Bohart in Bohart and Menke 1976: 521 (synonymy).

*Hoplisoides placidus nebulosus* (Packard), partim. Bohart in Bohart and Menke 1976: 521 (subspecies status).

**Type material.** *Gorytes nebulosus*: Lectotype ♀ (designated by Cresson, 1928: 48). “N.J.” [= New Jersey], “*Gorytes nebulosus* ♀ Pack.”, “Type No. 10063” (red label) (ANSP). The actual specimen was not examined but a digital image of the wing was provided by J. Weintraub. The wing pattern of *H. nebulosus* differs from all other sympatric species and is therefore sufficient to establish the identity of this species.

*Gorytes armatus*: Lectotype ♂ (designated by Gahan & Rohwer 1917: 427). “256” (red label), “845” (blue label), “1434” (yellow label), locality not stated [= Ottawa, cf. Harrington 1902] (ULQC, Provancher collection). Note: Provancher (1887) and Bohart (1997) erroneously recorded the type as female.

*Philanthus harringtonii*: Neotype ♀ (by present designation, justification see below). Ontario: Ottawa, 21 July 1885, Guignard (CNCI).

**Other material examined.** **CANADA, Québec:** Ste-Anne-de-Bellevue, ♀, 22 June 1965, G. Jamieson, ♂, 13 July 1965, E. Vlasak, ♂, 9 May[?] 1966, W. Boyle, ♂, 16 July 1967, R. Lalonde (LEMQ); 2♀, St. Hilaire, 25 July and 1 September 1927, J. W. Buckle (LEMQ). **Ontario: Rainy River Distr.,** ♀, Rainy River, 14 July 1960, S. M. Clark (CNCI). **Sudbury Distr.,** ♀, Capreol, 14 August 1972, W. M. M. Edmonds (ROME). **Ottawa-Carleton Reg.,** ♂, “21/6”, ♂, “23/6”, locality not stated [= Ottawa], W. H. Harrington collection (CNCI); 2♀, Stittsville, 16 and 30 June 1977, M. Sanborne (PMAE). **Muskoka Distr.,** ♀, Port Sydney, [day illegible] August 1923, N. K. Bigelow (ROME). **Hastings Co.,** Belleville, ♂, 30 July 1950, J. C. Martin (CNCI), ♂, 21 July 1950, J. C. Fisher. **Peterborough Co.,** 3♀, Norwood, 5-6 August 1983, T. D. Galloway (EDUM). **Bruce Co.,** ♂, Inverhuron Provincial Park, 25 July 2003, dunes, M. Buck. **Grey Co.,** 2♂, Hepworth dunes, 5 July 2003, M. Buck. **Dufferin Co.,** ♀, Boyne Valley Provincial Park, 1 km N Primrose, 44°6'15"N, 80°8'0"W, 27 July 2002, M. Buck. **Peel Reg.,** ♀, Forks of the Credit, gravel pit NW of Provincial Park, 43°49'24"N, 80°0'57"W, 5 August 2002, M. Buck. **Wellington Co.,** Guelph, ♂, June 1951, D. H. Pengelly, ♀, 12 July 1974, J. T. Huber, ♀, 10 August 1976, M. Waters, 2♀, 27 and 28 June 1978, W. A. Attwater, ♂, 28 June 1978, N. Pierce, ♂, 7 July 1978, S. Giamondi, ♀, 18 July 1980, S. Beierl, ♀ (PMAE), 10 August 1988, D. B. McCorquodale; ♀, Guelph. University Arboretum, 1-15 July 1991, malaise trap, M. Montes Castillo; Guelph, Wellington Street & Fife Road, ♀, 14 August 2004, ♀, 4 September 2004, M. Buck; ♀, Aberfoyle, 2 August 2004, M. Buck; ♀, Rockwood, Valley Road, 43°36'56"N, 80°08'28"W, 21 July 2004, M. Buck. **Waterloo Reg.,** ♀, Cambridge, 28 July 1975, W. J. Moolenbeek; ♂, Blair, 20 June 2006, M. D. Bergeron. **Welland Co.,** ♂, Niagara Falls, Niagara Whirlpool, 1 July 2004, S. M. Paiero. **Brant Co.,** ♀, Brantford Railway Prairie, 43°10'N, 80°19'W, 12 July 2002, S. M. Paiero. **Lambton Co.,** ♂, Thedford Conservation Area, 6 July 2003, B. Arnal & H. Duggan (BAR). **Essex Co.,** ♀, Pelee I., Fish Point, 5 August 1993, R. A. Cannings & H. Nadel (BCPM); ♀, Windsor, Ojibway Prairie, 42°15'51"N, 83°04'30"W, 28 July 2005, S.

M. Paiero; ♀, Windsor, nr. Ojibway Pk., 21-28 June 1982, S. A. Marshall (PMAE); Windsor, Springarden Road ANSI, 2♀, 31 July 2002, M. Buck, 7♀, 27 August 2002, M. Buck & S. M. Paiero. **New Brunswick:** ♂, Fredericton, Nashwaak, 26 July 1922, L. J. S. (CNCI). **Prince Edward Island:** Consecon Co., ♂, no locality, 28 August 1903, Evans (CNCI). **UNITED STATES** (all in USNM unless stated otherwise), **District of Columbia:** 7♂, 9♀ (1♂ [!] pinned with adult *Platycotis vittata*, 1♀ with adult *Entylia carinata*), Washington, various dates, June–September, 1945-1952, D. Shappirio; ♀, same locality, 2 September 1949, R. Boettcher. **Illinois:** ♀, Carlinville, Robertson (date not indicated). **Iowa:** ♀, Ames, June 1914, *Tilia americana* – 627; ♂, Jones Co., Anamosa, 27 June 1914, D. Stoner. **Kansas:** ♂, Topeka, 17 July (year not indicated). **Maryland:** ♀, Beltsville, 15-21 August 1950, D. Shappirio; 2♀, Fort Washington, 22 June 1947 and 1 July 1948, D. Shappirio; ♀, Odenton, 26 July 1947, D. Shappirio; ♂, Indian Head, 23 August 1902, Bridwell; ♂, ♀, Frederick Co., nr. Frederick, 30 June 1951, D. Shappirio. **Massachusetts:** ♀, Woods Hole, 24 August 1946, K. W. Cooper; ♀, “WH” [= Woods Hole?], 18 August 1946; Berkshire Co., ♂, North Adams, 4 July 1930, J. C. Bridwell. **Missouri:** ♀, Columbia, 15 August 1967, malaise trap, F. D. Parker. **New Jersey:** Princeton, ♂, 23 June 1946, ♂, ♀, “48f24”, ♀ (pinned with membracid nymph), 15 June 1941. **New York:** ♂, Ithaca, Lickbrook, 25 June 1940, P. P. Babiy (CASC); ♂, Ithaca, Six Mile Creek, 13 June 1937, P. P. Babiy (CNCI); ♀, Rensselaerville, 24 May 1914, K. W. C.; ♂, Powder Mills, “56g19”; 2♂, Rochester, 25 June 1939; ♂, Long I., Orient, 8 September 1953, R. Latham. **North Carolina:** ♂, Red Hill, 16 August 1957, L. A. Kelton (CNCI). **Tennessee:** ♂, Knoxville, 24 June 1920, C. G. Ainslie. **Virginia:** ♂, 22 July 1883, T. Pergande; Loudon Co., ♂, 31 May 1947, D. Shappirio. **West Virginia:** Hampshire Co., ♂, North River Mills, 29 May 1939, A. H. Clark. **Wisconsin:** ♀, Milwaukee. No locality: ♀, “Phil Rau No. 21”.

**Diagnosis.** Yellow spot of scutellum almost always entire (medially divided and partially suffused with brown in one male from Guelph, Ontario).

**Male.** Clypeus not distinctly bevelled, angle between plane of apical portion and clypeal disc  $>90^\circ$ ; apical margin slightly lamellate in about central half; lamellate rim becoming narrower laterally. Lateral clypeal hair tufts nearly straight except for slightly curved apical 1/4-1/3. FI with short papilla-like tyloid similar to one on FII; FXI with bare ventral area (devoid of microtomentum) at least as large as lateral ocellus. Wing (Fig. 3): Discoidal cell I clear; medial cell clear except weak infuscation near apex beyond level where Rs joins M; submarginal cell I clear except in small area contiguous to submarginal cell II. Metasomal tergum 5 black; yellow apical fascia absent or narrow (at most 5x as broad as long) and not interrupted medially.

**Female.** Wing (Fig. 4): Subdiscoidal cell infuscated in apical 2/5, clear along Cu in basal 3/5; discoidal cell I clear, except sometimes weakly and narrowly at extreme base; medial cell clear except apical infuscation (beyond level where Rs joins M) and small area in posterior corner (near fork of M and Cu); submarginal cell I clear except area contiguous to submarginal cell II. One unusual female from Rainy River, Ontario, shows a wing pattern that is somewhat intermediate with regard to *H. placidus pergandei* (i.e. with additional weak infuscation in discoidal cell I and submarginal cell I). Ground colour of propodeum and tergum 1 black. Pygidial carina bent near base, anteriormost sections slightly convergent basally.

**Discussion.** It is surprising that *H. n. nebulosus* has been confused with *H. placidus pergandei*. While differences between males are subtle, females of both species are easily separated by their distinctly different wing patterns. *Hoplisoides n. nebulosus* shows the same pattern as the western *H. nebulosus spiloferus*, *H. hamatus*, and *H. punctifrons* while *H. placidus pergandei* is very similar to the nominate subspecies. Based on their different wing patterns, Bohart (1997) correctly separated females of the three western taxa from *H. placidus* (s.str.) (l.c., p. 648: couplet 20) but failed to realize that *H. nebulosus* is different from the widespread eastern subspecies of *H. placidus*, which he incorrectly called "*H. placidus nebulosus*". In Bohart's key, females of *H. n. nebulosus* run to *H. hamatus*; males run to *H. spiloferus*, which is here considered the western subspecies of *H. nebulosus* (see below).

The reinstatement of *H. nebulosus* as a good species makes necessary a neotype designation for *Philanthus harringtonii* Provancher, a species currently standing in synonymy with *H. nebulosus*. This action is justified as follows: (1) The type material of *Philanthus harringtonii* is lost. Gahan & Rohwer (1917: 134) could not locate the type in the Provancher collection (now at ULQC) and speculated that it might have been returned to the collector, W. H. Harrington. However, the Harrington collection (now at CNCI) does not include any specimens labelled as *Ph. harringtonii*, neither does the Hymenoptera type collection at the CNCI. The absence of *Ph. harringtonii* material at ULQC was recently confirmed by G. Wagner (2002, in litt.). Bohart (1997: 656), obviously in error, reported to have examined the type of *Ph. harringtonii* which he recorded as female. The sex of the type was not stated by Provancher (1888) but the original description clearly applies to a male. (2) The identity of *Ph. harringtonii* cannot be ascertained from Provancher's (1888) original description. Despite the original generic combination, the description apparently refers to a *Hoplisoides* specimen provided by W. H. Harrington. The only two species that occur at the type locality, Ottawa, are *H. n. nebulosus* and *H. placidus pergandei*. The CNCI has specimens of both species collected by Harrington. The fairly subtle characters that separate males of the two species are not mentioned in the original description so the name could refer to either of the two. (3) The exact publication dates of the works by Provancher (1888: *Philanthus harringtonii*) and Handlirsch (1888: *Gorytes pergandei*) are unknown. This causes uncertainty with regard to the name that has to be applied to the northern subspecies of *H. placidus*. The present neotype designation for *Ph. harringtonii* resolves this uncertainty by fixing the identity of the species in its previous sense (i.e. as a junior synonym of *nebulosus* vs. a synonym of *pergandei*). The designated neotype was collected by W. H. Harrington at the type locality and was possibly examined by Provancher.

**Distribution.** Due to previous confusion with *H. placidus pergandei* the range of *H. n. nebulosus* is insufficiently known. Verified records are from eastern Canada (NB, PE, QC, ON) (Buck 2004), and the eastern U.S. (WI, IA, IL, MA, NY, NJ, MD, DC, VA, WV, NC, TN, MO, KS).

**Biology.** Preys on membracid nymphs and adults of *Entylia carinata* (Forster) and *Platycotis vittata* (F.) (Membracidae). Previously published prey records (adult and nymphal Membracidae, summarized by Krombein 1979 under "*H. placidus nebulosus*") pertain either to *H. n. nebulosus* or to *H. placidus pergandei*.

***Hoplisoides nebulosus spilopterus* (Handlirsch, 1888) stat. nov.**

*Gorytes spilopterus* Handlirsch, 1888: 414 (♀).

*Gorytes maculatus* Provancher, 1895: 140 (♀). Bohart in Bohart and Menke 1976: 521 (synonymy).

*Gorytes (Hoplisoides) pogonodes* Bradley, 1920 (♂). Bohart in Bohart and Menke 1976: 521 (synonymy).

**Type material.** Not examined.

**Material examined.** **CANADA, Alberta:** ♀, Medicine Hat, 17 July 1917, F. W. L. Sladen (CNCI); ♀, Writing-on-Stone Provincial Park, 6 km E at bridge, 12 August 1981, D. B. McCorquodale (PMAE); Writing-on-Stone Provincial Park, Sand Pit, ♀, 1 July 1981, ♂, 8 July 1982, ♀, 22 July 1982, D. B. McCorquodale (PMAE); ♀, Lake Newell, SE of lake, 18 July 1989, D. B. McCorquodale (PMAE). **British Columbia:** ♀, Salmon Arm, 4 July 1914, F. W. L. Sladen (CNCI); ♀, Oliver, 20 July 1923, E. R. Buckell (CNCI); Vernon, ♂, 3 ♀, 9 July 1920, M. H. Ruhmann, ♀, 6 August 1920, N. L. Cutler (CNCI); ♀, Osoyoos, Richter Pass, 28 June 1959, L. A. Kelton (CNCI). **UNITED STATES, California:** Colusa Co., 2 ♀, Ramsay Canyon, 10 and 14 May 1970, M. K. Sears (DEBU); 3 ♂, ♀, Thousand Palms, 10, 12, and 15 April 1955, W. R. Richards (CNCI). **Colorado:** ♂, Boulder, Valmont Butte, 5300 ft, 30 July 1961, J. R. Stainer (CNCI). **Texas:** Davis Mts. State Park, 5200 ft, 19-22 July 1973, E. Lindquist (CNCI); ♂, 10 mi W Fort Davis, Point Rocks, 5000 ft, 30 May 1959, W. R. M. Mason (CNCI); 3 ♂, ♀, 23 mi W Fort Davis, 4500 and 5000 ft, 1 June 1959, W. R. M. Mason and J. F. McAlpine (CNCI); ♀, Del Rio, Devil's River, 27 April 1959, J. F. McAlpine (CNCI). **MEXICO, Chihuahua:** 2 ♂, 35 mi NW Chihuahua, Majalca Road, 5500 and 6000 ft, 14-17 April 1961, Howden & Martin (CNCI).

**Diagnosis.** As nominate subspecies except for the following: male metasomal tergum 5 with an anvil-shaped ivory spot that is approximately 2.5x as broad as long (the reliability of this character requires further testing). Female propodeum and tergum 1 mostly red.

**Discussion.** Because of the absence of structural differences between *H. nebulosus* (s.str.) and *H. spilopterus* and their allopatric distribution, I propose subspecies rank for *H. spilopterus* under *H. nebulosus*. Similar geographic variation is also found in *H. placidus* where red-marked populations from Texas and other western localities were described as ssp. *birkmanni* (see below).

**Distribution.** Canada: Alberta (Carter 1925, identification tentative; Strickland 1947) and British Columbia (new record). Widespread in the western U.S., south to northern Mexico (Chihuahua, Sonora, Baja California) (Pulawski 2006). The easternmost known localities are in Nebraska, Colorado, New Mexico, and western Texas. The geographic boundary between this subspecies and ssp. *nebulosus* is insufficiently known. The apparent distributional gap in central Canada (Manitoba, Saskatchewan) is probably due to inadequate collecting.

**Biology.** Preys on adults and nymphs of various Membracidae genera (Krombein 1979).

***Hoplisoides placidus pergandei* Handlirsch, 1888, stat. nov. (Figs. 5, 6)**

*Gorytes pergandei* Handlirsch, 1888: 407 (♂). Wrongly synonymized with *Gorytes nebulosus* Packard by Bohart in Bohart and Menke 1976: 521 (synonymy not indicated as new but authorship mentioned in Bohart 1997: 656).

*Gorytes microcephalus* Handlirsch, 1888: 405 (♂). **rev. syn.** Wrongly synonymized with *Gorytes nebulosus* Packard by Bohart in Bohart and Menke 1976: 521.

*Hoplisoides placidus nebulosus* auctt., nec (Packard), partim. Bohart in Bohart and Menke 1976: 521, and subsequent authors.

**Type material.** *Gorytes pergandei*: Lectotype ♂ (by present designation). "Illinois", "C<sup>n</sup> de Saussure", "Gorytes pergandei Handl.", "Lectotype ♂ pergandei (RMB) Handl." (red label) (MHNG). The head is largely destroyed by dermestids but the right antenna and the clypeus are fully preserved. Syntype from Virginia not in MHNG, probably lost.

*Gorytes microcephalus*: Lectotype ♂ (by present designation). "Georgie" [= Georgia], "C<sup>n</sup> de Saussure", "Gorytes microcephalus Handl.", and one empty red label (MHNG). Right mid leg and hind legs missing. Other syntype not in MHNG, probably lost.

**Other material examined.** **CANADA, Ontario:** Kent Co., ♀, Rondeau Provincial Park, South Point Trail, west parking lot, 42°16'53"N, 81°51'16"W, Carolinian forest, 20 July 2004, D. K. B. Cheung; Rondeau Provincial Park, Group Campground, 42°17'35"N, 81°50'52"W, ♀, 11 July 2005, M. Buck, ♀, 11 August 2005, S. M. Paiero. **Lambton Co.,** ♀, Walpole I., nr. Chiefs Road, sand pits, 42°39'39"N, 82°29'47"W, 8 August 2005, S. M. Paiero. Further 21♂, 42♀ from the following counties and regions (detailed label data in Buck 2004): Brant, Carleton, Essex, Grey (♀ pinned with cf. *Campylenchia latipes* nymph), Kent, Lambton, Norfolk, Peterborough, Simcoe. **Québec:** 3♀ from Lanoraie, St. Anne's and 3 mi N Ste. Scholastique (see Buck 2004 for details). **UNITED STATES** (all in USNM except stated otherwise). **Georgia:** ♂, Savannah, 1 May 1937, P. W. Fattig; Rabun Co., ♀, Satolah, 2500 ft, 4 July 1957, W. R. M. Mason (CNCI). **District of Columbia:** 2♀, Washington, 10 August 1945 and 30 July 1946, D. Shappirio. **Indiana:** ♂, Elkhart. **Louisiana:** ♀\*, Keatchie, 14 June 1905, La. Crop Pest Comm. **Maryland:** Montgomery Co., ♀, 8 July 1945, D. Shappirio; ♀, Plummers I., 16 September 1972, P. D. Hurd; ♂, Beltsville, Agr. Res. Stn., 2 July 1949, D., R. & S. Shappirio; AnneArundel Co., ♀\*, nr. Patuxent, 3 July 1948. **Massachusetts:** ♀\*, Dennis, 4 July 1954, J. W. Green (CASC); ♀, "WH" [= Woods Hole?], 23 August(?) 1946. **Minnesota:** Olmsted Co., ♂ June 1898, ♀\*, no date, C.N. Ainslie. **Mississippi:** Lincoln Co., ♀\*, Peach, 28 May 1938, Turner; Lafayette Co., ♀, May 1945, F. M. Hull (CNCI). **New Hampshire:** ♀, Salem, 10 August 1948, D. Shappirio. **New Jersey:** ♀, Brown's Mills, 21 June 1908, C. T. Greene; ♀ (pinned with membracid nymph), Princeton, 15 June 1941, K. W. Cooper; ♂, Riverton, 20 June 1904; Camden Co., ♂, 28 June 1891, W. J. Fox collection. **North Carolina:** Dare Co., 15♂, 9♀, Kill Devil Hills, various dates, May–September, 1948–1958, 1966, K. V. Krombein and

D. G. Shappirio (USNM, 1♀ CASC); Cumberland Co., ♀, Fort Bragg, 27 September–3 October 1967, J. D. Birchim (CASC). **South Carolina:** 2♂, Cherry Grove Beach, 2 August 1966, G. S. Walley (CNCI). **Texas** (unassociated males cannot be separated from ssp. *birkmanni*): 3♂, Victoria, 16 May 1913, J. D. Mitchell; ♂, Jacksonville, 11 August 1906, F. C. Bishopp; Willis, ♂, 15 June 1903, ♀\*, 11 June 1903, Bridwell; ♂, Rosser, 28 June(?) 1905, on *Cassia* sp., C. R. Jones (CASC). **Virginia:** ♀, Great Falls, 15 June 1948, D. Shappirio.

\* = females with more or less infuscated apical part of subdiscoidal cell.

**Diagnosis.** Yellow spot of scutellum entire, not divided medially.

Male. Clypeus as in *H. nebulosus* but hair tufts usually more curved. FI with short papilla-like tyloid similar to one on FII; FXI with bare ventral area absent or smaller than lateral ocellus. Wing (Fig. 5): Degree (intensity) of infuscation variable, better developed in specimens from southeastern part of range. Discoidal cell I strongly to very weakly infuscated except clear longitudinal medial streak from base to apex; medial cell variably infuscated, infuscation always present distally along Rs and M, in some specimens extending over whole cell; submarginal cell I lightly to strongly infuscated in posterior half; subdiscoidal cell varying from completely clear to usually somewhat infuscated along anterior margin, in some specimens also with infuscation in distal 2/5. Yellow apical fascia of T5 at least 7x as broad as long (usually much more), sometimes medially interrupted.

Female. Wing (Fig. 6): Subdiscoidal cell infuscated along anterior margin, in a small number of specimens also in apical 2/5; discoidal cell I infuscated except lighter longitudinal medial streak from base to apex; medial cell infuscated along Rs, M, and M+Cu (more weakly so towards base); submarginal cell I infuscated but infuscation becoming lighter anteriorly. Ground colour of propodeum and tergum I black. Pygidial carina bent near base, anteriormost sections parallel to slightly convergent basally.

**Discussion.** As discussed above, the name *H. nebulosus* was misapplied to the widespread eastern subspecies of *H. placidus* (the nominate subspecies is restricted to Florida). The oldest available names for this subspecies are *pergandei* Handlirsch and *microcephalus* Handlirsch, both described in the same work. As first reviser, I am synonymizing *Gorytes microcephalus* with *H. pergandei*, which becomes the valid name for the subspecies. I prefer the name *pergandei* because *microcephalus* was described from Georgia, close to the range of the nominate subspecies. Through the present lectotype designation the type locality for *pergandei* is fixed as “Illinois” (the second syntype was from “Virginia”).

The designated *H. pergandei* lectotype already bears a lectotype label by R. M. Bohart. His designation was not published and is therefore invalid. The wing pattern of the specimen is somewhat faded and therefore only distinguishable with difficulty from *H. nebulosus nebulosus*. However, the absence of a bare spot on the last flagellomere clearly identifies the specimen as a member of the widespread eastern subspecies of *H. placidus*.

*Hoplisoides birkmanni* Baker, 1907 and its synonym *H. pruinosis* Baker, 1907 (synonymized by Bohart in Bohart and Menke 1976: 521) are here removed from synonymy with *H. nebulosus* (synonymized by Bohart 1997: 656), and reinstated as a subspecies of *H. placidus* (subspecies status first given by Bohart in Bohart and Menke 1976: 521): *H.*

*placidus birkmanni* Baker **ssp. restit.** This taxon was erected for southwestern populations of *H. placidus* (from Texas, etc.), in which the female has red markings on the propodeum, tergum 6, and sometimes tergum 1. It differs from the red-marked nominate subspecies from Florida in having well-developed yellow apical fasciae on terga 3-5, clear yellow markings on head, mesosoma, and metasoma (not suffused with orange-red), and weaker wing infuscation (as in *H. placidus pergandei*). We have examined 11♂, 16♀ of *H. p. birkmanni* from Texas, Kleberg and Kenedy Cos. (CASC).

**Distribution.** Due to confusion with *H. nebulosus nebulosus*, the range of *H. placidus pergandei* is insufficiently known. Verified records are from Canada (QC, ON) (Buck 2004) and the eastern U.S. (NH, MI, IN, MA, NJ, MD, DC, VA, NC, SC, GA, MS, LA, eastern TX).

**Biology.** Preys on nymphs of cf. *Campylenchia latipes* Say (Membracidae). Previously published prey records (adult and nymphal Membracidae, summarized by Krombein 1979 under “*H. placidus nebulosus*”) pertain either to *H. placidus pergandei* or to *H. nebulosus nebulosus*.

### *Hoplisoides hamatus* (Handlirsch, 1888) (Fig. 2)

**Material examined.** CANADA, British Columbia: ♀, Seton Lake, Lillooet, 15 June 1926, J. McDunnough (CNCI). UNITED STATES, California: 4♀ (DEBU), 13♂, 46♀ (CASC). Colorado: ♀ (CASC). Nevada: ♀ (CASC). New Mexico: 2♂, ♀ (CASC). Oregon: ♂, ♀ (CASC). Utah: 2♂, 6♀ (CASC).

**Diagnosis.** Yellow spot of scutellum divided medially.

Male. Clypeal bevel sharply defined, plane of bevel bent posterad  $\geq 90^\circ$ ; apical margin with weakly developed lamellate rim in middle third; lateral clypeal hair tufts almost semicircularly curved medially (curved more strongly than in related species) (Fig. 2). FI with short papilla-like tyloid similar to one on FII. FXI with bare ventral area (devoid of microtomentum). Wing as in *H. nebulosus* (Fig. 3). Metasomal tergum 5 black or with an yellow apical spot that is at most 1.7x as broad as long.

Female. Wing pattern as in *H. nebulosus* (Fig. 4). Ground colour of propodeum and tergum 1 black. Pygidial carina evenly curved towards base, anteriormost sections very slightly divergent or parallel to each other.

**Distribution.** Canada: British Columbia (first record from Canada). Widespread in the western U.S. (Krombein 1979); recorded as far east as “Dakota” by Fox (1896).

**Biology.** Preys on nymphs of several genera of Membracidae (Krombein 1979).

*Hoplisoides punctifrons* (Cameron, 1890)

**Material examined.** CANADA, Saskatchewan: 2♂, Elbow, 12 July 1960, A. R. Brooks (CNCI). Alberta: ♀, Scandia, 2 August 1949, G. A. Hobbs (CNCI); ♀, Orion, 17 July 1933, G. F. Manson (CNCI); ♂, Lower Kananaska Hwy., 5 August 1980, S. A. Marshall (DEBU); ♀, Writing-on-Stone Provincial Park, Sand-North, 1 August 1990, M. Klassen (PMAE); ♂, Lethbridge, 4 km SE Picture Butte, 20-29 July 1991, C. D. Michener (SEMC). British Columbia: 2♂, 2♀, Vernon, 25 July 1917, F. W. L. Sladen (CNCI). UNITED STATES, Arizona: 3♂, 4♀ (USNM), ♂, ♀ (CASC). California: 4♂, 3♀ (USNM), 9♂ (CNCI), 2♂, 1♀ (CASC). Colorado: ♂ (USNM), ♂ (CNCI). New Mexico: ♂, ♀ (CASC). North Dakota: 4♂ (USNM). Texas: ♂ (USNM), ♀ (CASC). Utah: ♀ (CNCI). Wyoming: ♀ (CSUC). MEXICO, Baja California Sur: ♀ (CASC).

**Diagnosis.** Very similar to *H. nebulosus spilopterus*; differs as follows.

Male. Clypeus more distinctly bevelled; apical margin lamellate only in about central 1/3-1/5; lamellate portion ending more or less abruptly laterally. FI with long linear tyloid dissimilar to short tuberculate tyloid of FII; FXI lacking bare ventral area (completely microtomentose).

Female. Tergum 2 reddish (except apical fascia), reddish areas on pronotum and laterally on scutum. The examined Canadian females differ from specimens from the southwestern U.S. in having well developed yellow apical fasciae on terga 3-4(-5) as *H. spilopterus*.

**Distribution.** Canada: Saskatchewan to British Columbia (first records for Canada). United States west of 100<sup>th</sup> meridian, Mexico (Sonora, Jalisco) (Bohart 1997).

**Biology.** Unknown.

*H. costalis* species group

**Diagnosis.** Lower metapleural pit much smaller than mid ocellus.

*Hoplisoides costalis* (Cresson, 1872)

**Material examined.** CANADA, Ontario: Halton Reg., ♂ Oakville, nr. Hwy 25 & Burnhamthorpe Road, 43°27'14"N, 79°47'32"W, 9 July 2004, S. M. Paiero. Kent Co., ♀, Rondeau Provincial Park, Group Campground, 42°17'35"N, 81°50'52"W, 20-22 July 2004, S. A. Marshall. Further 2♂, 14♀ from the following counties and regions (detailed label data in Buck 2004): Carleton, Essex, Halton, Huron, Kent, Norfolk, Lambton, Wellington, Wentworth, York. UNITED STATES, Florida: ♂ (USNM); South Carolina: ♂ (DEBU).

**Diagnosis.** Body black, marked with yellow. Male FI with linear tyloid extending over nearly entire length of flagellomere; FXI with large bare ventral area. Metapleuron parallel-sided

over most of its length, fairly abruptly narrowed towards lower pit. Wing infuscation similar to Fig. 7: Infuscated areas include apical and posterior areas of medial cell, submarginal cell I (paler or rarely clear anteriorly), submarginal cell II (except sometimes posteriorly), anterior half of submarginal cell III, discoidal cell I (posterior half paler, rarely clear), sometimes submedian cell weakly, and anterobasal corner of subdiscoidal cell. Terga 4 and 5 largely black, with narrow apical fascia; female tergum 6 black. Pygidial plate of female long, 1.6-1.8x as long as wide; lateral carinae gently curved, slightly divergent at base.

**Distribution.** Canada: Ontario (Buck 2004). United States east of 100<sup>th</sup> meridian, Mexico (Tamaulipas, Veracruz, Hidalgo, ?Yucatán) (Bohart 1997). Krombein (1979) also listed the species for Alaska, a record that appears highly unlikely and needs confirmation.

**Biology.** Preys on adults of at least ten genera of Membracidae (Krombein 1979; Buck 2004).

### *Hoplisoides pygidialis* (Fox, 1896) (Fig. 7)

**Material examined.** CANADA, Alberta: ♀, Writing-on-Stone Provincial Park, Sand Pit, 5 August 1982, D. B. McCorquodale (PMAE).

**Diagnosis.** Very similar to *H. costalis* except for largely yellow terga 4 and 5 and partially yellow female tergum 6. Wing as in Fig. 7.

**Distribution.** Canada: Alberta (Strickland 1947). United States west of 100<sup>th</sup> meridian (easternmost records from ND, NE), Mexico south to Chiapas and Yucatán (Bohart 1997, Pulawski 2006).

**Biology.** Unknown.

### *Hoplisoides tricolor* (Cresson, 1868)

**Material examined.** CANADA, British Columbia: 2♀, Osoyoos, Haynes Lease Ecol. Res., "Throne Area", 27 July 1988, C. S. Guppy (BCPM). UNITED STATES, Kansas: ♀ (CNCI). Utah: ♂ (CNCI).

**Diagnosis.** A very distinctive species with largely red and yellow body; black areas very restricted. Metapleuron gradually tapering from upper to lower pit. Wing pattern as follows: medial cell and submarginal cell I largely clear; infuscated areas include submarginal cell II and anterior two thirds of submarginal cell III, mostly posterior half of discoidal cell I, anterobasal third of discoidal cell II, apex of submedian cell, and most of subdiscoidal cell (paler posteriorly). Terga 3 to 5 largely yellow, with narrow black basal bands; female terga 5 and 6 red. Pygidial plate of female short, 0.9-1.2x as long as wide; lateral carinae gently curved, strongly divergent at base.

**Distribution.** Canada: British Columbia (first Canadian record). United States west of 100<sup>th</sup> meridian, Mexico (Sonora, Sinaloa, Nuevo León, Coahuila) (Bohart 1997).

**Biology.** Preys on adults and nymphs of *Parabolocratus* (Cicadellidae) (Krombein 1979).

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### References

- Bohart, R. M. 1997. A review of the genus *Hoplisoides* Gribodo (Hymenoptera: Sphecidae: Gorytini) in North America. *Proceedings of the Entomological Society of Washington* 99: 645-660.
- Bohart, R. M. and A. S. Menke. 1976. *Sphecoid wasps of the World*. University of California Press, Berkeley, Los Angeles, London. ix + 695 pp.
- Bradley, J. C. 1920. Descriptions, records and notes on North American Nyssonidae (Hymenoptera). *Transactions of the American Entomological Society* 46: 113-132.
- Buck, M. 2004. An annotated checklist of the spheciform wasps of Ontario (Hymenoptera: Ampulicidae, Sphecidae and Crabronidae). *Journal of the Entomological Society of Ontario* 134 (2003): 19-84.
- Carter, W. 1925. Records of Alberta Sphecoidea with descriptions of new species of Crabronidae. *The Canadian Entomologist* 57: 131-136.
- Cresson, E. T. 1928. The types of Hymenoptera in the Academy of Natural Sciences of Philadelphia other than those of Ezra T. Cresson. *Memoirs of the American Entomological Society* 5: 1-90.
- Evans, H. E. 1966. *The comparative ethology and evolution of the sand wasps*. Harvard University Press, Cambridge, Mass., xvi + 526 pp.
- Fox, W. J. 1896. Synopsis of the North American species of *Gorytes* Latr. *Proceedings of the Academy of Natural Sciences of Philadelphia* 1895: 517-539.
- Gahan, A. B. and S. A. Rohwer. 1917. Lectotypes of the species of Hymenoptera (except Apoidea) described by Abbé Provancher. *The Canadian Entomologist* 49: 427-433.

- Hadley, A. 2005. CombineZ version 5.1. <http://www.hadleyweb.pwp.blueyonder.co.uk>.
- Handlirsch, A. 1888. Monographie der mit *Nysson* und *Bembex* verwandten Grabwespen. III. Sitzungsberichte der Kaiserlichen Akademie der Naturwissenschaften. Mathematisch-Naturwissenschaftliche Classe. Abtheilung I, 97: 316-565.
- Harrington, W. H. 1902. Fauna Ottawaensis. Hymenoptera – Superfamily II. – Sphegoidea. The Ottawa Naturalist 15: 215-224.
- Krombein, K. V. 1979. Sphecoidea. pp. 1573-1740 In Catalog of Hymenoptera in America north of Mexico. Vol. 2: Apocrita (Aculeata). Krombein, K. V., P. D. Hurd, D. R. Smith, and B. D. Burks (eds.), Smithsonian Institution Press, Washington.
- Packard, A. S. 1867. Revision of the fossorial Hymenoptera of North America. I. Crabronidae and Nyssonidae. Proceedings of the Entomological Society of Philadelphia 6: 353-444.
- Provancher, L. 1885-1889. Additions et corrections au volume II de la faune entomologique du Canada traitant des Hyménoptères. Québec, 475 pp.
- Provancher, L. 1895. Les dernières descriptions de l'abbé Provancher. Le Naturaliste Canadien 22: 79-80, 95-97, 110-112, 129-131, 140-142, 157-159, 172-174, 189-191.
- Pulawski, W. J. 2006. Catalog of Sphecidae sensu lato (= Apoidea excluding Apidae). [http://www.calacademy.org/research/entomology/Entomology\\_Resources/Hymenoptera/sphecidae/Genera\\_and\\_species\\_PDF/introduction.htm](http://www.calacademy.org/research/entomology/Entomology_Resources/Hymenoptera/sphecidae/Genera_and_species_PDF/introduction.htm) (last accessed June 2006).
- Strickland, E. H. 1947. An annotated list of the wasps of Alberta. The Canadian Entomologist 79: 121-130.



***STRONGYLOPHTHALMYIA PENGELLYI* N. SP., A SECOND  
SPECIES OF NEARCTIC STRONGYLOPHTHALMYIIDAE  
(DIPTERA)**

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**Abstract**

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*Strongylophthalmyia pengellyi* new species is described from Canada (New Brunswick, Ontario, Québec) and the United States (Michigan, Utah). A key is provided to distinguish it from the only other Nearctic species, *S. angustipennis* Melander. The species shows unusual sexual dimorphism of the legs and of the wing. Copulatory posture suggests function for some of these modifications. Adult *S. pengellyi* were sampled with sticky traps, Malaise traps, and by searching tree trunks. An association with decrepit trembling aspen is presumed based on occurrence of adults of both species on tree trunks and the larvae of *S. angustipennis* under the bark. Beetles and fungi may play a role in the life history of these flies. *Strongylophthalmyia pengellyi* has a flight period from late May to late July with a peak in early to mid-June; *S. angustipennis* begins flying in early June but continues until September. Comparison of captures using coloured sticky traps suggests superiority of colourless translucent boards.

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**Introduction**

Strongylophthalmyiidae is a relatively small family of slender, long-legged flies divided into two genera—the monotypic Southeast Asian genus *Nartshukia* Shatalkin, 1993 and the type genus *Strongylophthalmyia* Heller, 1902. Shatalkin (1996) incorrectly refers to a third genus, *Longinasus* Frey, 1956 which was recognized as a junior subjective synonym of the richardiid genus *Ozaenina* Enderlein, 1912 by Steyskal (1968).

*Strongylophthalmyia* currently includes 45 species with the majority (38) occurring in the Oriental and Australasian Regions, two of these ranging as far north as Japan. Although there are no formal records of described species in Australia, Evenhuis (1989) refers to unpublished records and undescribed Australian species. There are six Palaearctic species and one previously described Nearctic species, *S. angustipennis* Melander. No species of Strongylophthalmyiidae are known from the Neotropical or Afrotropical regions (two African species previously treated as *Strongylophthalmyia* were transferred to the Clusiidae by Barraclough 2000).

The most comprehensive keys are provided by Frey (1956—world species), Steyskal (1971—world species), Shatalkin (1993—Palearctic species; 1996—*crinita*- and *punctata*-groups), and Iwasa (1992—Japanese species). The distinction between *Nartshukia* and *Strongylophthalmyia* rests primarily with the position of the ocellar tubercle, which is characteristically displaced anteriorly in *Strongylophthalmyia* (see Shatalkin 1993 for a short discussion of the affinities of *Nartshukia*). This suggests that the one species of *Nartshukia* is the sister species to a monophyletic *Strongylophthalmyia*.

For some time, the genus *Strongylophthalmyia* was classified with the Psilidae (as late as Shewell 1965). Hennig (1940) described four species, treating them as Psilidae but later suggested that this genus might be better treated as a separate family associated with the Tanypezidae (Hennig 1958). The Strongylophthalmyiidae is now widely recognized as the sister taxon to the Tanypezidae based on several synapomorphies (e.g. hypandrium with internal arch-shaped sclerites, internal sclerite within 8<sup>th</sup> female abdominal segment with loop-like [spatulate] anterior end (Roháček 1998), and possibly the biramous anterior spiracle of the larva). Some authors (e.g. Griffiths 1972; McAlpine 1997) argue for combining these two closely related groups into a single family, but separate family status for the Strongylophthalmyiidae is retained here following the position taken by many others (Steyskal 1987a, b; McAlpine 1989; Yang and Wang 1992; Shatalkin 1996; Iwasa 1998; Roháček 1998; Papp et al. 2006; but see Roháček 1998 and McAlpine 1997 for further discussion).

Biological and life-history data for these small flies are particularly lacking in North America. Steyskal (1987b) reports on adult specimens of *S. angustipennis* emerging from “felled trees” from Laniel, Québec (tree species unknown, CNCI—see codens below). European records are primarily those of Krivosheina (1981; 1984) who reports on rearing larvae of *S. ustulata* (Zetterstedt) and *S. pictipes* Frey from under bark of rotting logs of aspen, and of *S. stackelbergi* Krivosheina from under the bark of elm and birch. The larvae are described as common on wet bast [inner bark or phloem] and pupation occurs in the upper layers of bast under the dead bark. Shatalkin (1993) summarizes field observations made on the behaviour of adults of *S. ustulata*, *S. crinita* Hennig, *S. varicornis* Shatalkin, and *S. pictipes*. Additional unpublished records from New Guinea mention adult behaviour mimicking ants with which they were collected on banana leaves while others were collected from leaves of *Alocasia* in Australia (Evenhuis 1989).

### **History of discovery**

Despite its wide distribution, there is a particular Ontario flavour to the discovery of a new species of Nearctic *Strongylophthalmyia*. The following section recognizes the contributions of others, emphasizes that “new” species can be quite “old”, and that serendipity can play a role in the description of our native fauna.

Around 1979, J. F. McAlpine (CNCI) showed me representatives of *Strongylophthalmyia* during a visit as a student. These included three female specimens (Aspen Grove, Utah, 1975) collected during a study of scolytids (Petty 1977; BYUC) attacking trembling aspen, *Populus tremuloides* Michaux. In 1975, McAlpine determined these to be a new species near *S. pictipes*.

A male and a female from southwestern Québec (La Ferme, Adrien Robert, 1943) were determined by G. E. Shewell (CNCI) in 1946 as a new species of *Strongylophthalmyia*.

McAlpine had not mentioned anything about the modifications of the male wing and mid basitarsus because he had not seen a male. These two specimens only came to light during this study, presumably after being moved to the same drawer as the Utah specimens (most likely after his retirement in 1985 or Shewell's death in 1996).

Recently, a single female specimen was found with other *S. angustipennis* in the CNCI holdings of unidentified Psilidae (M. Buck, DEBU). It had been collected in New Brunswick (Kouchibouguac National Park) by J. F. McAlpine in 1977! This specimen must have been forgotten by McAlpine as it was collected two years after his identification of the Utah specimens.

In 2002, a research team led by S. B. Holmes (GLFC) began investigating the effects of forest harvesting practices on birds south of White River, Ontario (see Mosley et al. 2006 for summary of relevant data from 2003). While providing assistance in identification of insects that might serve as food for birds, I recognized a substantial number of *Strongylophthalmyia*. They clearly represented two species, one being the same as represented by the specimens housed at CNCI.

Subsequent to this, I installed additional sticky traps (2003) on one of the research blocks south of White River. This effort and active searching for flies, narrowed the focus to dead or dying trembling aspen here and elsewhere (label data from the Utah specimens at CNCI had not yet been consulted). Additional sampling was then carried out elsewhere in 2004 and 2005. The results from these efforts are the subject of this paper which provides a formal description of this "new" species of *Strongylophthalmyia* along with field observations and capture data from sticky traps during the period 2002–2005.

## Materials and Methods

***Specimen depositories*** (Evenhuis and Samuelson 2006). The examined material is deposited at the following institutions: AMNH–American Museum of Natural History, New York, New York (D. A. Grimaldi, T. C. Nguyen); BYUC–M. L. Bean Collection, Brigham Young University, Provo, Utah (R. Baumann, S. Clark); CNCI–Canadian National Collection of Insects, Agriculture and Agri-Food Canada, Ottawa, Ontario (J. M. Cumming); DEBU–University of Guelph Insect Collection, Department of Environmental Biology, University of Guelph, Guelph, Ontario (S. A. Marshall, M. Buck); EMUS–Entomological Museum, Department of Biology, Utah State University, Logan, Utah (W. Hanson); GLFC–Great Lakes Forestry Centre, Entomological Collection, Sault Ste. Marie, Ontario (K. Nystrom); LACM–Natural History Museum of Los Angeles County, Los Angeles, California (B. V. Brown); ROME–Royal Ontario Museum, Toronto, Ontario (D. Currie, B. Hubley); UBCZ–The Spencer Entomological Museum, University of British Columbia, Vancouver, British Columbia (G. Scudder, K. M. Needham); USNM–National Museum of Natural History, Smithsonian Institution, Department of Entomology, Washington, DC (A. L. Norrbom, F. C. Thompson).

***Specimen preparation and morphology.*** Flies were removed from sticky boards after loosening with Histoclear II (National Diagnostics, Atlanta, GA), soaked overnight, heated in fresh Histoclear II, transferred to two washes of hot 95% ethanol, and then critical point

dried. Abdomens and genitalia were cleared in hot 10% NaOH solution, neutralized with glacial acetic acid, and examined in glycerin. Electron micrographs were obtained using a Hitachi 570 scanning electron microscope. Morphological terms are primarily those used by McAlpine (1981). Abbreviations: S—sternite, T—tergite, TS—syntergosternite.

**Collecting methods.** Traps with large translucent sticky boards (two boards of 26 cm x 26 cm slotted and oriented vertically in an “X”; Coroplast™, Coroplast Inc., Granby, QC) on poles at about 3 m above ground were used in White River, Ontario in 2002 and 2003. The study site and traps are described by Mosley et al. (2006) and the traps were deployed at different intensities of sampling (90 traps in 2002, 36 traps in 2003). Coloured mini sticky boards (14.2 cm x 12.5 cm) of four different “colours” (1 colourless and translucent, and 3 opaque colours of light blue, white, light yellow) were deployed in 2003 (Block 6, upland Sites 1, 3, 4, 9; see Mosley et al. 2006). The coloured boards were mounted individually in two linear series beginning at two maximum heights of about 3 m (high) and 1.5 m (low). The 24 traps (6 poles on each of 4 sites) represented all permutations of four colours (replicated on each pole, high and low). Tangle-Trap® (brushable formula, The Tanglefoot Co., Grand Rapids, MI) was applied in a thin film leaving a non-sticky narrow border on one short side as a handling surface. Trapping ran from 29 May to 23 July with four consecutive trapping periods of two weeks each (second trapping period included flies removed in the field after four days). Additional trapping was conducted to compare only colourless translucent and light blue mini boards at the lower height (1.5 m, n=6), paired and parallel to each other (25 June to 9 July). All mini boards were transported in rigid plastic compact disc trays (Model TCD30, Case Logic Canada Inc., Toronto, ON).

Mini sticky traps were subsequently used in seven other localities in attempts to record additional geographic locations for *S. pengellyi* new species. These consisted of four colourless translucent mini boards at the lower height (1.5 m) (note: specimens labeled “multi-colour” sticky trap originate from the 2003 study; all other specimens labeled as “opaque”, “opaque mini”, or “translusc.[ent][sic] mini” sticky trap were captured on colourless translucent large or mini boards). Six short (1.5 m) poles were set out in each of six aspen stands in early to mid June 2004 (Cochrane—32 days, Hearst—31, Mattawa—20, McKerrow—20, Pancake Bay—21, Shabakwa Corners—35) and in one stand in late May in 2005 (Sault Ste. Marie—96).

Malaise traps fitted with ethanol collection heads were erected on or near the plots in the White River research area (Block 6) in 2003. Live adults were collected into 70% ethanol. Others were transported to the laboratory in screened tubes for further observation in either a flight cage supplied with an aspen branch or in Petri plates.

Immature stages were obtained from a decrepit standing trembling aspen (Dubreuilville: no leaves and only main branches remaining, bark in lower stem still photosynthetic). The tree was felled and strips of bark and inner bark (bast) were removed on 20 May and 2 June 2005 from an original height of about 8–10 m and transported in pails to the laboratory. Previously, in 2003, a small sample of aspen branches from a broken crown from this site had been held in the laboratory and yielded adult scolytid beetles but no strongylophthalmyiid flies.

**Field sites.** Significant observations or collections were made at three other sites besides the main study site at White River (Mosley et al. 2006): 1–Dubreuilville, Ontario (~35 km WSW, several visits, 2003–2005) was a short distance off the side of the highway and the source of immatures of *Strongylophthalmyia*; 2–Thessalon, Ontario (~95 km NNE, 18 June 2004) was also a roadside site of dense regrowth of trembling aspen where an aggregation of *S. pengellyi* was observed; 3–Sault Ste. Marie, Ontario (Baseline Rd., 21 May–25 August 2005) was an old disturbed, regrowth stand of mostly aspen and a modest source of both species of *Strongylophthalmyia* on sticky traps near recently blown down aspens.

**Statistical analysis.** The influence of colour and height on fly captures of the mini sticky boards in 2003 (SigmaStat, Windows Version 3.10.0, Systat Software Inc., Richmond, CA) was tested on accumulated seasonal counts for each board (pole-height-colour combination). Normality and homogeneity of variances for two-way ANOVA could not be achieved after transformation so nonparametric techniques were used. Count data for the four boards of each height on each pole (n=24) were combined for tests of the effect of height. Data for the two boards of each colour on each pole (n=24) were combined to test for effects of colour. Nonparametric Kruskal-Wallis tests were conducted on the seasonal catches of males, females, and both genders combined. Significant Kruskal-Wallis tests ( $\alpha=0.05$ ) were followed by Student-Newman-Keuls multiple comparisons to recognize any possible pairwise differences.

## Results and Discussion

### *Strongylophthalmyia* Heller, 1902

*Strongylophthalmyia* Heller, 1902: 226, (new name for *Strongylophthalmus* Hendel, 1902).

Type species: *Chyliza ustulata* Zetterstedt, 1847: 2427. Frey, 1956: 129 (key, world); Steyskal, 1971: 142 (key, world); Shatalkin, 1993: 124 (1994: 155, key, Palaearctic), 1996: 151 (key, *crinita*-group); Iwasa 1992: 660 (key, Japan).

*Strongylophthalmus* Hendel, 1902: 179. Type species: *Chyliza ustulata* Zetterstedt, 1847: 2427, original designation. Preoccupied by *Strongylophthalmus* Motschulsky, 1860: pl. X.

*Labropsila* de Meijere, 1914: 241. Type species: *Labropsila polita* de Meijere, 1914: 242, designated by Hennig, 1941: 36.

**Generic diagnosis.** The Nearctic species are small, slender, long-legged, blackish flies with paler areas on head, thorax and legs. The wing is mostly hyaline, usually with a faint apical cloud. The ocelli are displaced forward, the vibrissa absent, and the thorax elongate.

### Key to the Nearctic species of *Strongylophthalmyia*

1. Frons extensively yellow anteriorly. Two notopleural setae present and no additional setulae. Setae of head and thorax mostly pale. Femora mostly yellow, at most with preapical black band on hind femur and brown band on mid femur. Wing without

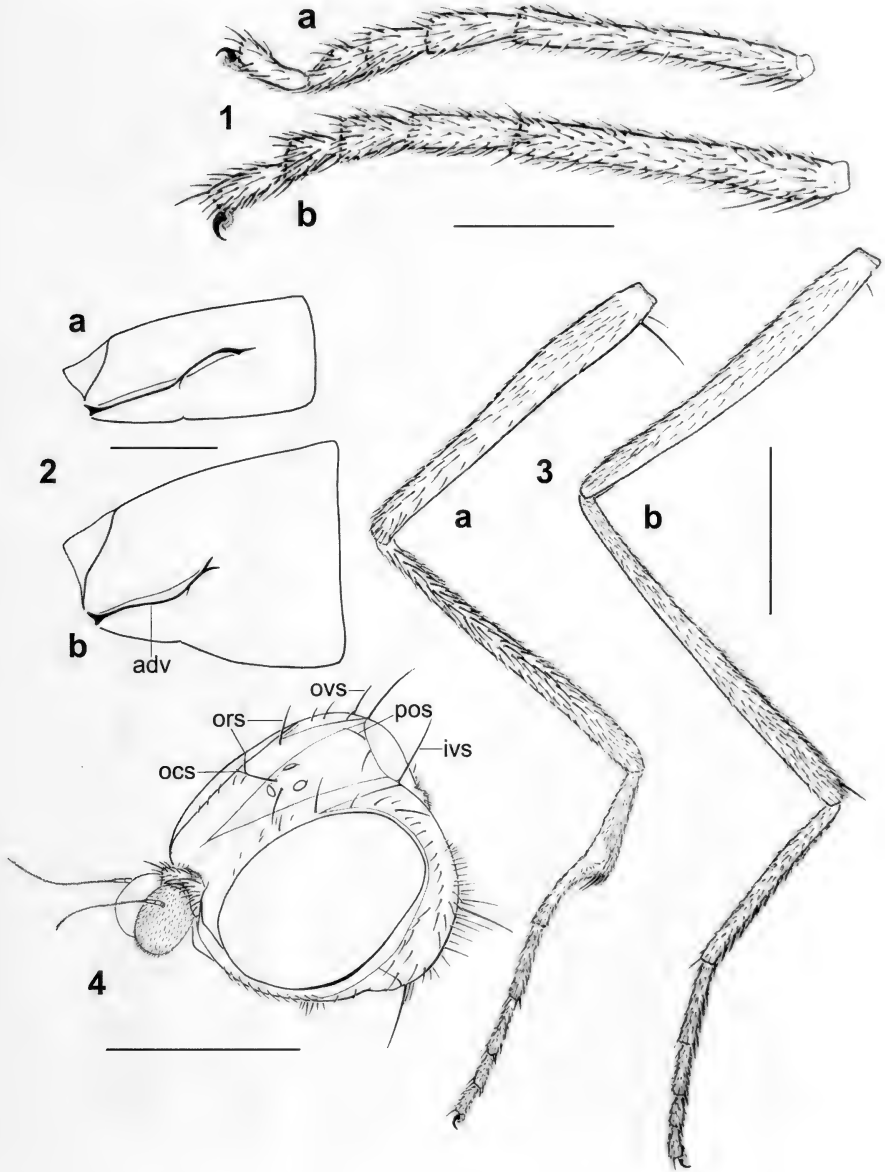
- any discernible swelling or darkening at junction of veins CuA<sub>1</sub> and dm-cu. Male mid basitarsus simple .....*S. angustipennis* Melander
- Frons usually entirely black, at most narrowly brown anteriorly. Only the posterior notopleural seta present but with additional pale short setulae. Setae of head and thorax mostly black. Femora mostly black, at most somewhat paler apically. Wing with darkening and/or swelling at junction of veins CuA<sub>1</sub> and dm-cu, swelling absent to medium-sized in female (Figs. 13–15) but large in male (Fig. 12). Male mid basitarsus curved and with angular anteroventral projection (Figs. 3a, 16–18).....  
.....*S. pengellyi* **new species**

*Strongylophthalmyia pengellyi* runs to *S. pictipes* in Shatalkin’s (1993) key to Palaearctic species. Besides three obvious characters unique to *S. pengellyi* (one notopleural seta, discrete darkening of the veins or black spot at the junction of veins CuA<sub>1</sub> and dm-cu, modified mid basitarsus of the male), it can be distinguished from *S. pictipes* by its entirely dark frons in both genders and the complete absence of a dark median band in the wing in either gender. Steyskal’s (1971) outdated key to World species (missing *S. pictipes*) gives more ambiguous results because of alternative possible interpretations of the colour of the postpronotum. If the postpronotum is considered black (usually but ranges from brown to black), then *S. pengellyi* will run to the Southeast Asian species *S. nigricoxa* (de Meijere). I have not seen specimens of *S. nigricoxa* (known from Java and Sumatra) but Steyskal (1971), Frey (1956), and de Meijere (1914) would have noted at least one of the striking characters listed here as autapomorphies of *S. pengellyi* if they were found in *S. nigricoxa*.

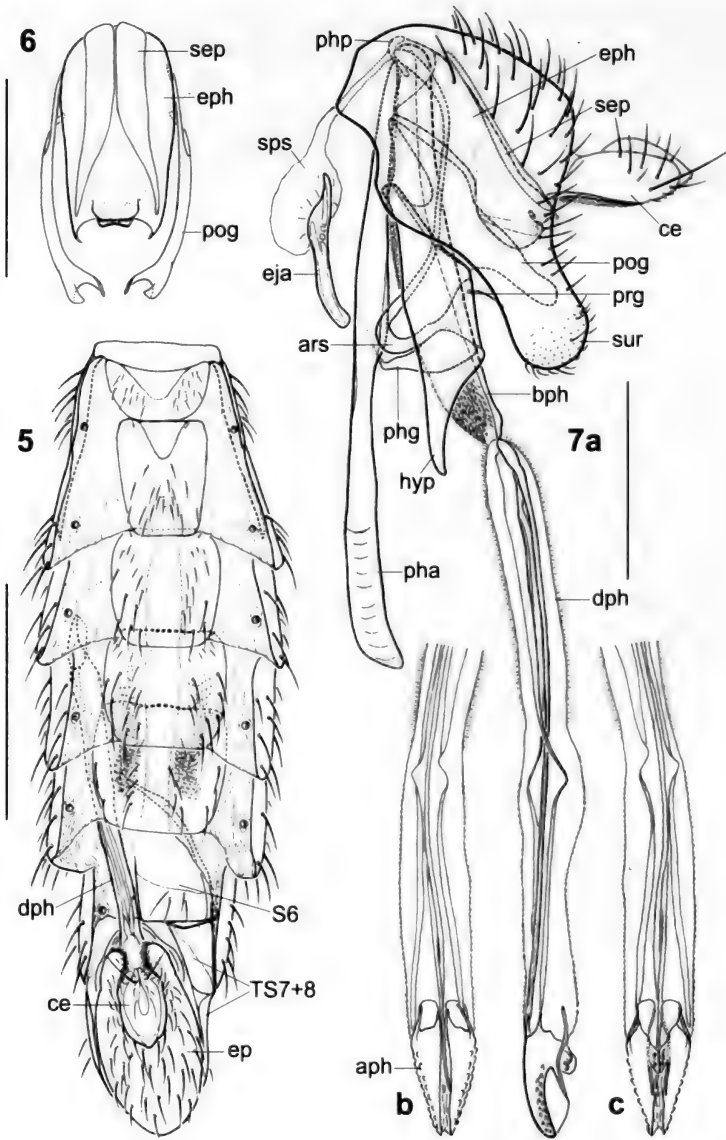
*Strongylophthalmyia pengellyi* **new species** (Figs. 1–24)

**Diagnosis.** Small (2.7-5.0 mm) elongate flies with long slender legs; mostly black except for reddish-brown eye, brown to yellow parts of antenna, face, parafacial, prosternum, front coxa, front knee, apex of front tibia and tarsi, and white gena and halter knob. Mid basitarsus of male highly modified. Wing hyaline with brown veins, diffuse apical cloud usually present but better developed in male; junction of veins CuA<sub>1</sub> and dm-cu expanded into a raised black spot in male, reduced or absent in female. Setae mostly black and setulae mostly pale; notably only a single (posterior) notopleural seta present (setae generally shorter than those in *S. angustipennis*).

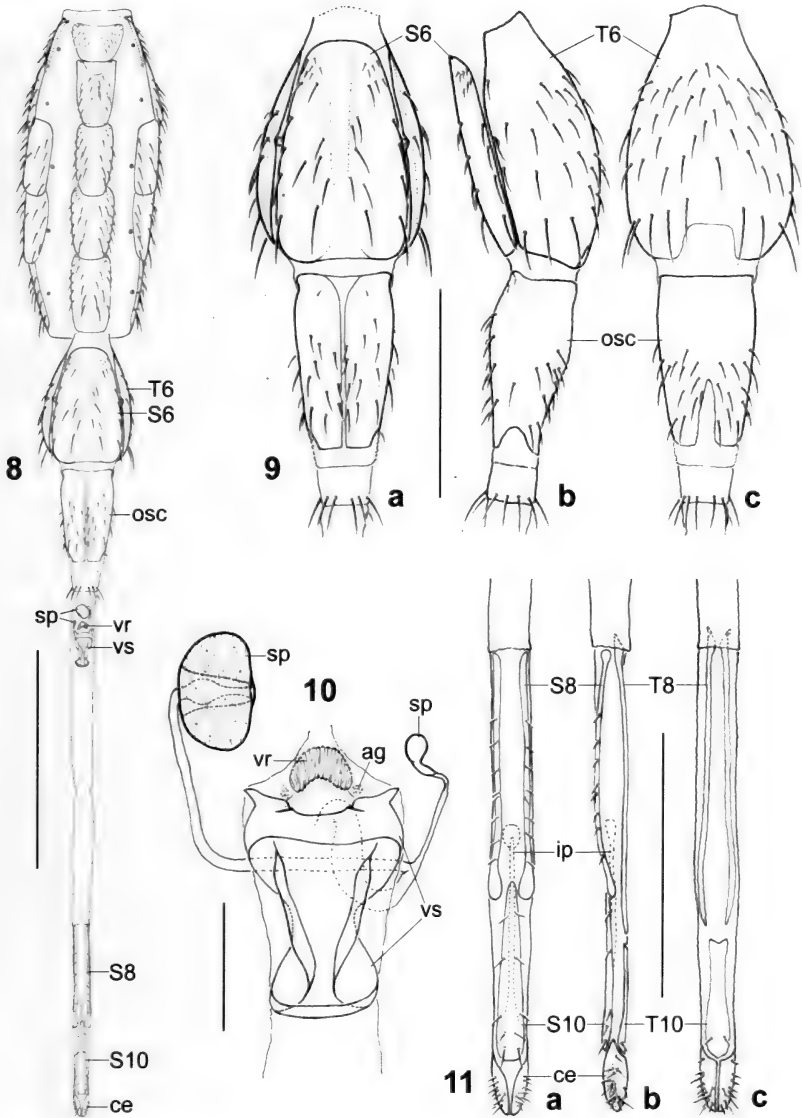
**Male description.** 2.69-3.86 mm long. **Head** (similar to Fig. 4: female). Length about 1.1-1.3X height, tapering to antenna, occiput inflated posterolaterally; in frontal view widest at mid-height of eye, width about 1.4-1.5X height. Frons shiny black with fine longitudinal striations, sometimes narrowly brown on apical margin (yellow to ocellar tubercle in *S. angustipennis* male, at least halfway in female); subquadrate, narrowing slightly anterior to ocelli, widening more abruptly above; in profile, anterolateral corners projecting above margin of eye. Ocellar triangle more coarsely striate dorsally, apex reaching about 2/3-3/4 distance from anterior ocellus to frontal margin; ocellar tubercle displaced anteriorly from postocellar setae by about 1.5X its length. The convergent inner vertical setae are the longest cephalic setae, arising distinctly behind level of postocellars, length subequal to distance



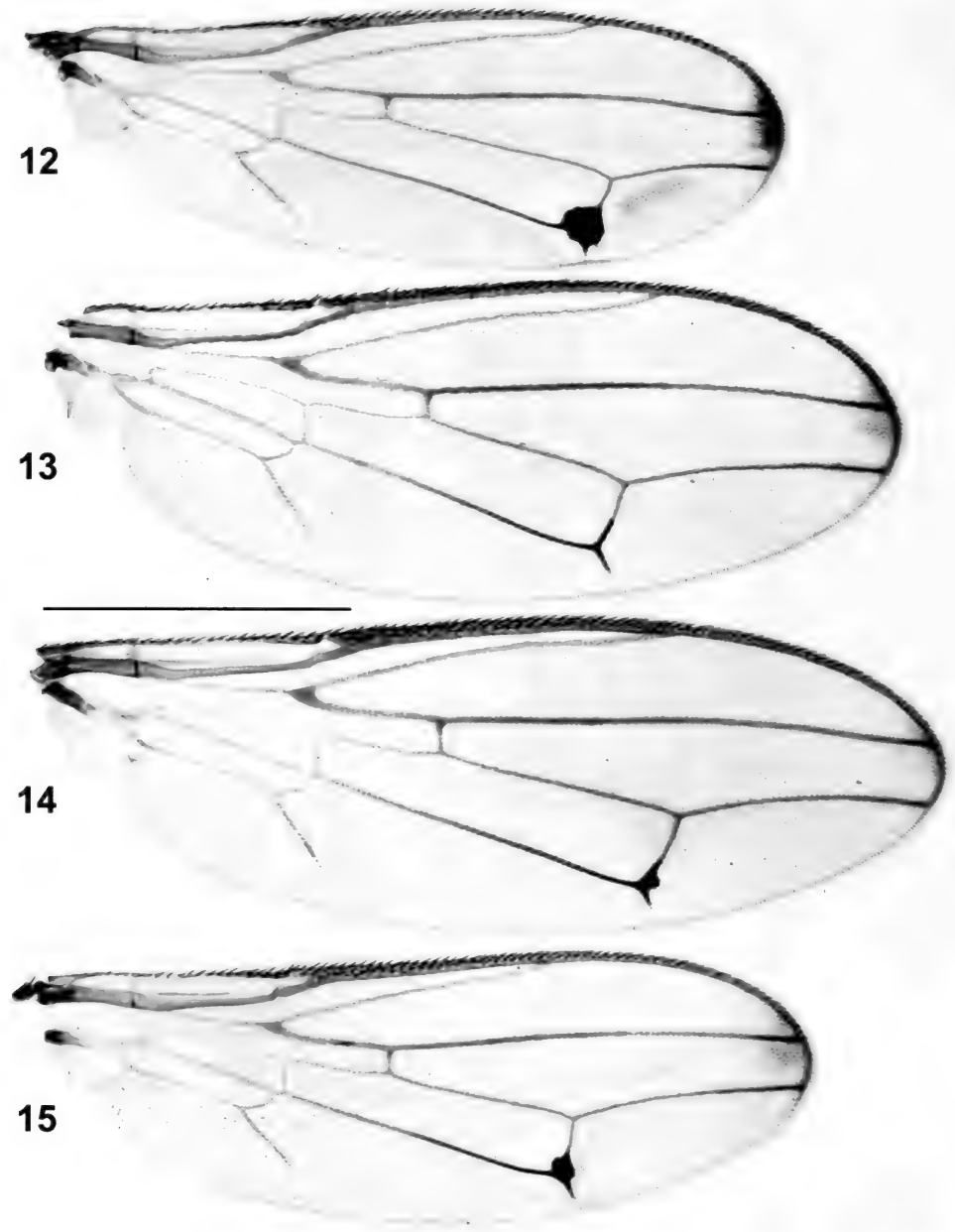
FIGURES 1–4. *Strongylophthalmyia pengellyi* n. sp., head, legs and abdomen. 1–Left front tarsus, posterior view, a) male, b) female (scale bar=0.2 mm). 2–Tergites 1+2 with adventitious suture, left lateral view, a) male, b) female (scale bar=0.2 mm). 3–Left middle leg, posterior view, a) male, b) female (scale bar=0.5 mm). 4–Head, female, dorsolateral view (scale bar=0.5 mm). Abbreviations: adv–adventitious suture, ivs–inner vertical seta, ocs–ocellar seta, ors–orbital setae, ovs–outer vertical seta, pos–postocellar seta.



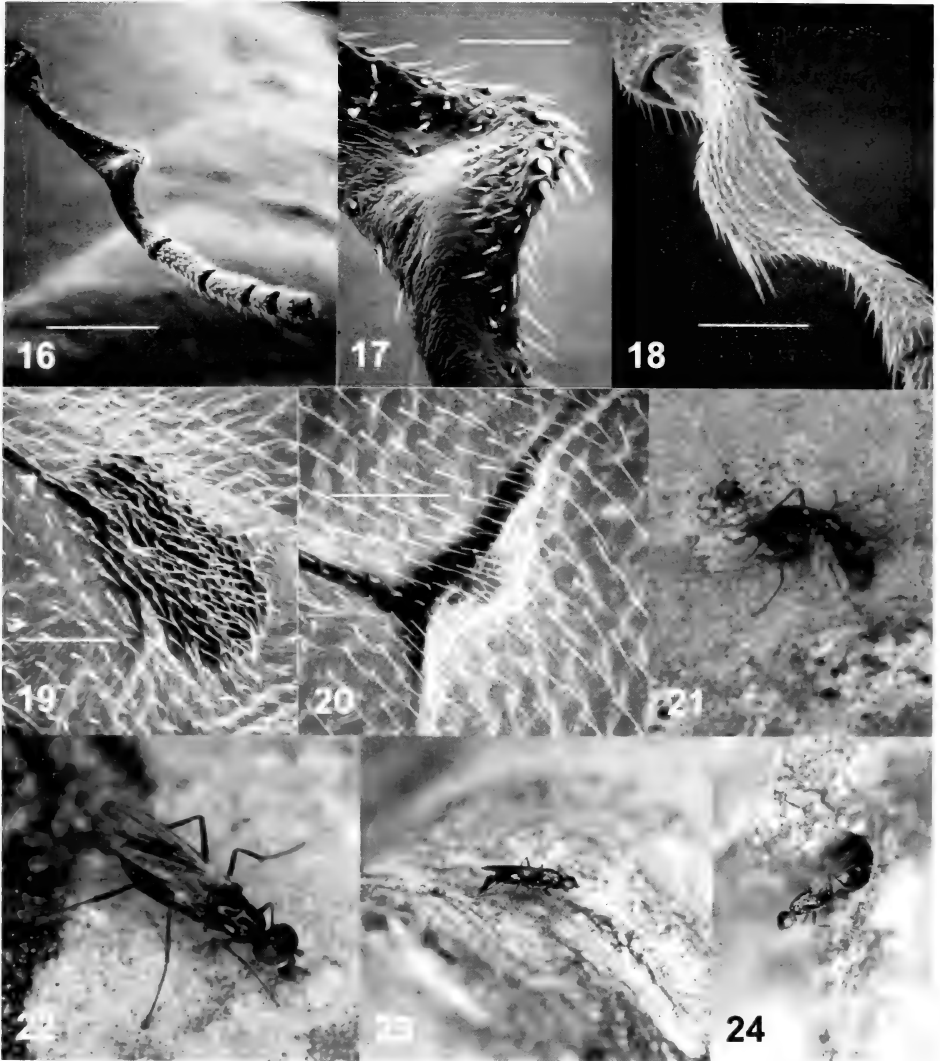
FIGURES 5–7. *Strongylophthalmyia pengellyi* n. sp., male abdomen and genitalia. 5–Abdomen, ventral view (scale bar=0.5 mm). 6–Subepandrial sclerites, epiphallus, and postgonites, posterior view (scale bar=0.2 mm). 7–Genitalia, (scale bar=0.2 mm), a) left lateral view, b) distiphallus, dorsal view, c) ditto, ventral view. Abbreviations: aph–acrophallus, ars–arch-like sclerite of hypandrium, bph–basiphallus, ce–cercus, dph–distiphallus, eja–ejaculatory apodeme, ep–epandrium, eph–epiphallus, pha–phallapodeme, phg–phallic guide, php–phallophore, pog–postgonite, prg–pregonite, sep–subepandrial sclerite, sps–sperm pump sac, sur–surstylus.



FIGURES 8–11. *Strongylophthalmyia pengellyi* n. sp., female abdomen and genitalia. 8–Abdomen with ovipositor extended, ventral view (scale bar=1.0 mm). 9–Segments 6 and 7 a) ventral view, b) left lateral view, c) dorsal view (scale bar=0.5 mm). 10–Internal structures including spermathecae, vaginal sclerite, ventral receptacle, and possible sessile accessory glands in dorsal wall, ventral view (scale bar=0.1 mm). 11–Apex of ovipositor with segment 8, tergite 10, sternite 10, and cerci (scale bar=0.5 mm). Abbreviations: ag–accessory gland? (see text), ce–cercus, ip–internal process of S10, osc–oviscap, sp–spermatheca(e), vr–ventral receptacle, vs–vaginal sclerite.



FIGURES 12–15. *Strongylophthalmyia pengellyi* n. sp., male and female wings (dorsal) showing black swelling at junction of  $CuA_1$  and  $dm-cu$  (scale bar = 1.0 mm). 12–Male. 13–15–Female (showing variation).



FIGURES 16–24. *Strongylophthalmyia pengellyi* n. sp., electron micrographs of male mid basitarsus, wings, and photographs of adults in field. 16–17–Male left mid tarsus, 16–Ventral view (scale bar = 176  $\mu$ m), 17–Midventral angulation of basitarsus (scale bar = 38  $\mu$ m). 18–Same, anterodorsal view (scale bar = 75  $\mu$ m). 19–20–Junction of veins CuA<sub>1</sub> and dm-cu on left wing, dorsal surface, 19–Male (scale bar = 43  $\mu$ m), 20–Female (condition similar to Fig. 14; scale bar = 51  $\mu$ m). 21–Copulation attempt on downed aspen trunk (White River, Ontario, 2003). 22–Female “tasting” surface of downed aspen trunk (ibid.). 23–Female “probing” surface of branch on downed aspen top with ovipositor (Dubreuilville, Ontario, 2003). 24–Female backed into scolytid(?) beetle hole, ovipositor greatly extended but not visible in image (Sault Ste. Marie, Ontario, 2005).

to insertion of postocellar of opposite side. Divergent outer vertical seta about 1/2-2/3 length of inner vertical, arising at about level of postocellars. Postocellar setae divergent, subequal to outer vertical. Proclinate divergent ocellar setae about 1/2-3/4 length of inner vertical. One or two short (subequal to or shorter than lower orbital), black reclinate to laterocline setulae arising between upper orbital and outer vertical (*S. angustipennis* with 1-2 usually pale setulae, 1 often longer than anterior orbital). Two reclinate to laterocline orbital setae: upper orbital subequal to postocellar, arising at about level of posterior ocelli; lower orbital about 1/2-2/3 length of upper orbital arising at about level of anterior ocellus. Three to six pale setulae arising anterior to lower orbital. Anterior margin of frons with about 3-4 pairs of pale setulae above antennae. Occiput convex and setulose but with well-defined concave median occipital plate glabrous except for compact grouping of short black supracervical setulae. Short pale postocular setulae removed from eye margin by own length, continuing ventrally to genal margin. Similarly short pale occipital setulae sparsely scattered especially mediolaterally, much longer ventrally, longest two pale setae at ventrolateral corner and near ventrolateral margin of occipital foramen. Lunule very narrowly exposed, yellowish but darker medially. Parafacial narrowing ventrally, yellow to white, antennal groove yellowish brown, both with brown medial margin, tomentose dorsally; parafacial densely white tomentose ventrally where meeting gena. Medial plate of face brownish yellow, palest centrally, microtomentose (often folded or obscured especially in air-dried specimens). Gena narrow, at its narrowest point subequal to maximum width of palpus; densely microtomentose white with short pale reclinate marginal setulae to and curving above posterior brown (dorsally yellow in *S. angustipennis*) glabrous triangular part; less dense tomentose band on posterior orbit narrowing posterodorsally; triangular part of gena posteriorly wide about 4-5X width of tomentose orbital band (not properly viewed in Fig. 4; only 2.5-3.3X in *S. angustipennis*). Compound eye reddish brown, obliquely elliptical, glabrous. Antenna short, yellowish brown (entirely yellow in *S. angustipennis*) except arista and dorsal portion of flagellomere 1 beyond insertion of arista which are dark brown to black, especially on lateral surface. Scape with short marginal setulae, those on medial surface pale, on lateral surface black. Pedicel with setulae as on scape plus outstanding black setula dorsally. Flagellomere 1 oval, slightly longer than wide, with short pale pilosity. Aristal length equal to anterior frontal width; aristomere 1 inconspicuous, aristomere 2 as long as or slightly longer than wide; cilia of aristomere 3 short, longest about equal to width of aristomere 1 (at least 1.5X width in *S. angustipennis*). Mouthparts black to brown (palpus yellow to apically brown in *S. angustipennis* male), clypeus darkest, membranous parts yellow to brown or grey. Clypeus narrow, medially slightly wider than palpus. Palpus with black apical setulae; other setulae of mouthparts pale.

**Thorax.** Elongate, black to brownish black, somewhat lighter ventrally; prosternum posteriorly yellowish; proepisternum (especially dorsally), postpronotum (sometimes), anepisternum anterodorsally, and supralar area brown, often obscurely. Broad precoxal bridge with posterior microtomentose triangular plates yellowish to brown, glabrous anterior section entirely brown to black (black only on anterior margin in *S. angustipennis*). Proepisternum with several short pale setulae anteroventral to anterior spiracle near coxal insertion. Postpronotum with scattered short pale setulae. Anterior notopleural seta absent (present in *S. angustipennis*); posterior notopleural seta black (rarely pale), subequal to tegular seta; a few short pale setulae present (absent in *S. angustipennis*), similar to

those dorsally on scutum; presutural supra-alar seta absent (sometimes present in *S. angustipennis*). Notum elongate, transverse suture arising at about midpoint. Scutal setulae short (longer in *S. angustipennis*), broadly distributed, mostly pale, those on extreme anterior margin black, slightly longer; presuturally including three distinct bands (one medial and one along each dorsocentral line) of 2-3 indistinct rows each, bands merging anteriorly; postsuturally, acrostichal setulae dispersed in 4 indistinct rows, setulae in dorsocentral lines in a single row, with glabrous strip lateral to dorsocentral lines (as in *S. angustipennis*). The single postsutural dorsocentral seta about 1.5X length of inner vertical, supraalar seta shorter, both black; postalar seta pale, subequal to length of notopleural. Scutellar setae black, in one subapical cruciate pair, about 1.5X length of dorsocentral. Anepisternum posterodorsally with short pale reclinate setulae in broad band narrowing ventrally, and with one outstanding pale seta near hind margin. Katepisternum with pale setulae ventrally and posterodorsally. Anepimeron with 4-5 pale setulae. Meron dorsally with pale setulae (absent in *S. angustipennis*) anterior to those below spiracle.

**Legs.** Elongate, narrow, mostly black to dark brown (in *S. angustipennis*, white to yellow with apices of mid and hind femora brown to black and tarsi darkened to brown apically) except dark brown to yellow front coxa (especially anterior and posterior surfaces), front and mid trochanters, tips of tibiae and all tarsi (apical segments often darker); mid coxa sometimes yellowish on posterior surface. Front knee narrowly brownish yellow dorsally, pale area extending ventrally to about 1/3 of femur and tibia; less distinct in vicinity of joint in other legs. Fine pale setae (about 10) on front coxae not noticeably longer than coxal diameter (about 25-30 in *S. angustipennis*, much longer than coxal diameter in male only); single outstanding pale seta basoventrally on mid (Fig. 3a) and hind femora (*S. angustipennis* male with 3-5 elongate basoventral setae on mid femur, 1 on hind femur, legs otherwise similar to female). Basitarsus of front and mid leg equal in length to combined length of tarsomeres 2-5 (Figs. 1a, 3a), hind basitarsus equalling length of tarsomeres 2-4. Front tarsomere 4 excavated apicodorsally (Fig. 1a; to receive reflexed tarsomere 5?), dorsal length basal of emargination about 1/2 that of ventral length; tarsomere 5 slightly depressed dorsally. Mid tibia apically depressed on anterior surface; setae longer on posterior surface, becoming shorter distally (Fig. 3a), without apicoventral setae (present in *S. angustipennis*). Mid basitarsus highly modified (Figs. 3a, 16-18), arcuate, widening to a broad, flat anteroventral projection at the midpoint, abruptly narrowed and arcuate in distal 1/3; basal 2/3 bearing short strong setulae ventrally, longest and strongest at apicoventral angle of projection (front and mid tarsi and mid tibia of *S. angustipennis* not modified).

**Wing** (Fig. 12). Hyaline, with narrow infusate area (diffuse and indistinct in *S. angustipennis*) surrounding apex of  $R_{4+5}$  widening posteriorly but not reaching M; often with obscure infuscations parallel to veins (more obvious in *S. angustipennis*), especially posterior margin of M and dm-cu; veins mostly brown, black surrounding junction of veins  $CuA_1$  and dm-cu. Distinctive black "spot" or swelling centred on junction of veins  $CuA_1$  and dm-cu, raised above plane of membrane on dorsal surface (Fig. 19), bearing dense microtrichia on both surfaces (veins unmodified and all brown in *S. angustipennis*). Costa running to apex of M; sector of  $CuA_1$  between bm-cu and  $CuA_2$  usually reduced or absent. Crossvein rm arising at basal 1/3 or less of cell dm. Cell dm elongate, reaching to level of apex of  $R_{2+3}$  or beyond; distal portion of M slightly to strongly arcuate, parallel to  $R_{4+5}$  in distal 1/3. Costagial seta absent; tegula with one outstanding seta. Vein  $A_1$  not reaching

wing margin. Calypters (as in *S. angustipennis*) whitish; basal marginal cilia of upper calypter pale as long as anepisternal seta, distal cilia shorter and grey. Halter with pale brown stem and white knob.

**Abdomen** (Fig. 5; similar to *S. angustipennis*). Shiny black with black setae; elongate. T1–T6 without setae in midline, broadly so on T1+2. T1+2 about 1.5X as long as basal width, with lateral, adventitious suture extending posteriorly to level of spiracle 2 (Fig. 2a). T3–T5 each about 1/2 length of T1+2. Pleural membranes densely covered in dark grey to black appressed microtrichia. S1 short, trapezoidal, broadly and deeply emarginate anteriorly producing anterolateral arms or projections; sparsely setose except medial sclerotization weak and glabrous often appearing emarginate posteriorly. S2 elongate, trapezoidal, anteromedially emarginate and weakly sclerotized and slightly depressed posteromedially (appearing H-shaped when cleared), setose on posterior half but glabrous in posteromedial weak area, anterolateral corners deflected dorsally. S3–S4 roundly quadrate to trapezoidal, medially weak and depressed except for narrow anterior margin, setose except for glabrous medial area, setae in anterolateral corners shorter; S4 sometimes with a few scattered spicules in middle of lateral setose areas (as in Fig. 5). S5 similar but slightly asymmetrical (shorter right side, lip of genital pouch), setose laterally except for elongate patch of dense short spicules on either side of medial area, concave within and lateral to these patches.

**Terminalia** (Fig. 5; similar to *S. angustipennis*). T6 slightly longer than each of T3–T5, slightly asymmetrical, shorter on right side. Spiracle 6 near midpoint of T6. S6 strongly asymmetrical, with oblique heavily sclerotized anterior margin bearing right sensory setula at apex of anteromedially flexed right margin (in medial wall of genital pouch), left sensory setula at midline. S6 running posterodorsally to fuse with anterior margin of TS7+8; broad posterior portion bearing two groups of 2–6 setae left of midline, those in right group slightly longer; glabrous right side weak, concave, receiving base of aedeagus. Genital pouch opening at right posterior margin of S5 and extending into segment 3 on right side. TS7+8 asymmetrical, slightly longer than T6 on dorsal midline, about 1.4X its length on left side; setose but without elongate setae of T1–T6; incision on left ventral margin; left anteroventral margin heavily sclerotized bearing right sensory setula at apex and left sensory setula laterally.

**Genitalia** (dorsal and ventral in reference to the aedeagus is made from copulatory position—Fig. 7a; similar to *S. angustipennis* with minor differences in shape). Epandrium (Fig. 7a) with short setae as in TS7+8. Surstylus a simple elongate, basally narrowed and distally rounded lobe, fused with epandrium; setae along posterior margin shorter apically; setulae densely clustered on inner surface of apex. Cercus elongate with angular apex, widest at middle; sclerotization weakening posteriorly; apical portion setose with one outstanding preapical seta. Pair of narrow vertical subepandrial sclerites (Figs. 6, 7a) closely appressed to posterior surface of epiphallus (in retracted position), running from near base of epiphallus, narrowing and diverging to anterior bases of cerci. Hypandrium relatively short, U-shaped, articulating posterolaterally with epandrium; short mediadorsal extensions articulating with phallapodeme to form phallic guide; additional mediadorsal arch-shaped sclerites looping dorsally then posteriorly as thin ribbons to base of basiphallus and phallapodeme. Pregonite obscure, fused with hypandrium, bearing single seta near medioventral angle (base of arch-shaped sclerite). Postgonite apically narrowing and bifurcate (posterior view, Fig. 6), apex of outer process a short broad point. Epiphallus broad, with angular anterobasal corners

meeting posterior bases of postgonites, narrowing in middle (lateral view, Fig. 7a), with complex apex; anterior surface concave but with raised, medial projection leading to an obliquely posteriorly flexed, heavily sclerotized medial apex; posterior surface broadly convex with a sclerotized, apically setulose, apical convex tab (Fig. 6), which in turn has a subapical anteromedial projection meeting the heavily sclerotized medial apex of the anterior surface. Basiphallus simple, gradually widened apically (in lateral view, Fig. 7a), ventral surface sclerotized especially marginally and apically, otherwise membranous with strong dense proclinate microtrichia; phallopore small, J-shaped in profile. Distiphallus long, extending into abdominal segment 3 (Figs. 5, 7), mostly membranous with fine and sparse microtrichia, erect in basal half, reclinate in apical half; 3 internal ribbon-like sclerites arising at base of distiphallus ventrally, eventually terminating dorsomedially and dorsolaterally at acrophallus; “medial” sclerite basally broader than other two, actually originating on left side and continuing toward dorsal surface, longitudinally split in apical 1/4, terminating in dorsomedial separation in acrophallus (Fig. 7b); 2 lateral ribbon-like sclerites arising to right side of “medial” sclerite, these cross over bringing most lateral sclerite (on right side) to the left side, the other from the middle to the right side, both continuing to base of acrophallus but weakened and bent at midpoint (a flexure or torsion point; more distal in *S. angustipennis* at about 0.6 of length). Acrophallus dominated by pair of heavily sclerotized hook-like sclerites that are laterally serrate in apical 2/3, with thin basal projections dorsomedially and dorsolaterally (Figs. 7a, b), the latter meeting the lateral ribbon-like sclerites of the distiphallus; basoventrally converging as blunt tab (Figs. 7a, c); pair of internal ventral plate-like sclerites, sinuate in lateral view (Fig. 7a), greatly narrowed apically and fusing laterally with ventral tab. Phallapodeme simple, rod-like, very elongate; sclerotization weaker apically and at articulation with phallic guide. Ejaculatory apodeme with narrow blunt anterior end, arrowhead-shaped posterior end (viewed dorsally), latter with 5-7 pores, supporting sperm pump sac.

**Female description.** Similar to male with the following variances. 2.95-4.75 mm (to apex of segment 7). **Head** (Fig. 4). 1-3 small setulae above upper orbital (1-2 in *S. angustipennis*, as in male). Ocellar seta about 1/2-2/3 length of inner vertical. 3-9 small setulae anterior to lower orbital, occasionally with one above the lower orbital. Ventral postoccipital setae shorter, with outstanding pale seta near foramen but long seta near ventrolateral corner black (pale in *S. angustipennis*). Glabrous portion of gena rarely with 1-2 short proclinate setulae (as in Fig. 4). Flagellomere 1 often more extensively darkened, only a narrow band of yellow basally (entirely brown to centrally yellow in *S. angustipennis*).

**Thorax.** Notopleural seta always black (pale in *S. angustipennis*).

**Legs** (not modified, similar in structure to *S. angustipennis*). Tarsi more often more extensively darkened. Mid (Fig. 2b) and hind femora lacking outstanding basoventral seta. Front tarsus not modified (Fig. 1b), tarsomere 4 not strongly excavated apicodorsally with basodorsal length more than 1/2 of ventral length; tarsomere 5 not depressed (but sometimes as an artifact of desiccation). Mid tibia (Fig. 2b) without enlarged setae on posterior surface; without apical depression on anterior surface; with posterior apicoventral seta about 0.8-1.5X apical width of tibia, yellow or black, sometimes with shorter anterior apicoventral seta (both strong in *S. angustipennis* female, weaker in male). Mid basitarsus not modified (Fig. 2b), similar to front and hind leg but with elongate ventral setae in basal 1/3 absent.

**Wing** (Figs. 13–15). Infuscations less developed or absent (female and male more similar in *S. angustipennis*—Steyskal 1987b, p. 777, Fig. 59.1). Apical cloud smaller or absent, usually present only as small indistinct infuscation surrounding the apex of  $R_{4+5}$ . Junction of veins  $CuA_1$  and dm-cu with veins darkened (Fig. 13), often with small black projection posteriorly (Figs. 14, 20), rarely larger (Fig. 15) but never as large as in male. Cell dm of more variable length, crossvein dm-cu sometimes not (Fig. 13) reaching level of apex of  $R_{2+3}$ ; crossvein rm arising at basal 1/3 to 2/5 of cell dm.

**Abdomen** (Fig. 8; similar to *S. angustipennis*). Broader than in male; largest setae not as well developed. T1+2 with length about 1.9X basal width; adventitious suture more angular at junction of T1–T2, shorter and not reaching level of spiracle 2; medial bare area of T1 portion larger. T5 narrowing posteriorly. S1–S2 lacking posteromedial weakening, S2 not appearing H-shaped. S3–S5 more elongate, medially glabrous but not weakened or depressed. S4–S5 symmetrical, lacking short spicules or lateral depressions.

**Terminalia and genitalia** (similar to *S. angustipennis*). Segment 6 about 1.5X length of segment 5 (Figs. 8–9); T6 dorsally domed, urn-shaped, narrowest basally with narrow reflexed anterior margin, widest in apical third, posterior margin with shallow trapezoidal medial emargination (Fig. 9c). S6 widening apically, setation similar to S3–S5 (Fig. 9a). Segment 7 with T7 and S7 fused to form sclerotized oviscape in basal 3/4, apical 1/4 membranous with posteromarginal ring of about 10 setae; oviscape with narrow weakening on ventral midline, widening to anterior notch (Fig. 9a), widest in basal 1/3, tapering apically, setulae more numerous posterodorsally and posteroventrally, small depression laterally near base, posterior margin with emarginations laterally (Fig. 9b) and dorsomedially (Fig. 9c). Eversible narrow ovipositor sheath (connecting segments 7–8), about 2.7X length of segment 7. Segment 8 slightly shorter than segment 7 (Figs. 8, 11). T8 a pair of ribbon-like sclerites with twisted spatulate bases and acute apices (Fig. 11c). S8 a pair of shorter ribbon-like sclerites, curving dorsally at bases and apices (Fig. 11b), basal tips blunt and apical tips spatulate, each with a series of widely spaced setulae (Fig. 11a). T10 elongate, with slight basal emargination, apical 1/3 ovoid with apical point, with a pair of preapical setulae (Fig. 11c). S10 longer than T10, running basomedial to apices of S8; margins ill-defined but broadly rounded apically, tapering to acute base; 5 pairs of setulae, apical pair about 2X length of others; internal medial process continues basally beyond apices of S8, ending in spatulate tip (Fig. 11a). Cerci elongate, sclerotized, fused medially but narrowly desclerotized along midline both dorsally and ventrally; setulose especially laterally where sclerotization is weak or lacking (Fig. 11). Sclerotized, short subcylindrical spermatheca with deep apical invagination, a second much reduced spermatheca (sometimes not sclerotized) and duct, the two ducts joining before entering the vagina dorsally (Fig. 10). Pair of sessile, granular structures basolateral to insertion of spermathecal duct (possibly accessory glands). Ventral receptacle tapered-reniform with annular corrugations. Vaginal sclerite broad, anteroventrally convex with ventral and lateral projections on anterior margin (Fig. 10); continuing posterolaterally as pair of weakly sclerotized, twisted plates joined posteriorly by weak narrow band in ventral wall.

**Discussion of morphology.** According to McAlpine (1989), loss of the anterior notopleural seta is a groundplan feature of group II of his Diopsoidea (including families Somatiidae, Psilidae, Nothybidae, Megamerinidae, Syringogastridae, and Diopsidae). It is interpreted

as a convergent condition and autapomorphy of *S. pengellyi*.

Steyskal (1987b) refers to the presence of three orbital setae in *S. angustipennis*. This condition is only slightly different from that in *S. pengellyi* where one of the setulae above the upper orbital seta can be quite long. This third “orbital” is clearly shorter than the upper orbital and is interpreted to be an enlarged setula in this position. Papp et al. (2006) interpret enlarged setulae above the second orbital as additional orbital setae and describe a similar condition in *S. palpalis* Papp where the “middle” orbital is the longest. Other Southeast Asian species have additional developed setulae/setae interpreted as orbitals or otherwise (e.g. 4 orbitals in *S. macrocera* Papp; 3 orbitals and “an additional lateral vertical/occipital seta” in *S. thaili* Papp (Papp et al. 2006)). The homology of these setae should be investigated in the context of this modified area of the head.

The pigmented swelling at the junction of veins CuA<sub>1</sub> and dm-cu may be developmentally achieved by a controlled enlargement of the veins in this area. The thickness of the swelling is similar to that of the veins and the density of microtrichia is more similar to their distribution on the veins than the membrane. The dark pigmentation is limited to the swelling and the neighbouring portions of the veins.

All reports of *Strongylophthalmyia* indicate a single sclerotized spermatheca. The vestigial second spermatheca found here in *S. pengellyi* (also present in *S. angustipennis*) is the first such record in the family. The interpretation of the sessile structures embedded in the dorsal wall of the vagina as accessory glands is tentative. No ducted structures were found which could be interpreted as accessory glands.

Steyskal's (1987b, p. 778, Fig. 59.3) illustration of the distiphallus of *S. angustipennis* is incomplete. The distal portion of the distiphallus, including the acrophallus, is missing as a result of partial removal of the abdomen (personal observation of dissected specimen used for this illustration revealed the apical portion of the distiphallus still embedded in the base of the abdomen—CNCI). The acrophallus is very similar to that in *S. pengellyi* but the flexure or torsion point is more distal, at about the 0.6 level of the distiphallus (including acrophallus) compared to the 0.5 level in *S. pengellyi*.

The aedeagus is illustrated here with the tips of the acrophallus pointing ventrally (Fig. 7a). At rest in the genital pouch (right side), they are pointing medially (Fig. 5) and must be rotated 90° around the long axis of the distiphallus to the illustrated copulatory position (see discussion below regarding mating behaviour). The juxtaposition of the bases of the three internal sclerites of the distiphallus suggests that the distiphallus has undergone some structural rotational modifications to assist this.

**Type Material Examined: Holotype male:** “CAN: ON: ~13.6 km S Hawk Jct., Hwy #101, 17.vi.2004, K. N. Barber, pooter, bleeding *Populus* 47°58.15'N 84°31.81'W”, “HOLOTYPE ♂ *Strongylophthalmyia pengellyi* n.sp. K. N. Barber 2006”, intact (CNCI).

**Paratypes: CANADA, New Brunswick:** Kouchibouguac N[ational] P[ark], 9 July 1977, J. F. McAlpine, Code-6023Q, ♀ (CNCI). **Ontario:** Same data as holotype, ♂, 4♀ (CNCI); ~8.4 km SW Chapleau, Hwy #101, 17 June 2004, pooter, fresh *Populus* log, 47°46.41'N 83°28.11'W, K. N. Barber, 7♀ (DEBU); ~14 km W Cochrane, 7 June–9 July 2004, opaque mini sticky traps, mostly *P. tremuloides*, 49°03.1'N 81°12.1'W, L. Rowlinson, 5♂, 40♀ (BYUC, DEBU, UBCZ); ~35 km WSW Dubreuilville, 1.8 km W Jct. Hwys. #17 & #519, boreal mixedwood, pooter, downed *Populus* top, 48°17.46'N 84°54.08'W, K. N. Barber,

17 June 2003, 5♀, 23 June 2003, 4♂, 7♀, 7 July 2003, 4♀, 6 July 2004, ♀; same location but dieing [sic] *Populus* trunk, 23 June 2003, 5♂, 2♀, 7 July 2003, ♀; same location but 15 June 2004, live *Populus* trunk, ♀; same location but 27 June 2005, standing aspen, ♂, 3♀, downed aspen snag, 3♀ (all DEBU); same location but 15 June–6 July 2004, opaque mini sticky traps, K. N. Barber, 11♂, 73♀ (DEBU, LACM, ROME); ~38 km W Hearst, 8 June–9 July 2004, opaque mini sticky traps, mostly *P. tremuloides*, 49°44.7'N 84°09.9'W, L. Rowlinson, ♀; Hwy #17, ~2.5 km E McKerrow, opaque mini sticky traps, mixed forest, 46°17.5'N 81°42.9'W, K. N. Barber, 12–20 June 2004, 2♂, 4♀, 20 June–2 July 2004, 5♀; Hwy #17, ~4.7 km W Pancake Bay P[rovincial] P[ark], 15 June–6 July 2004, opaque mini sticky traps, mixed forest, 46°57.98'N 84°44.49'W, K. N. Barber, 11♀; S[ault] S[te.] Marie, Baseline Rd., pooter, downed *Populus tremuloides*, 46°31.40'N 84°24.40'W, K. N. Barber, 31 May 2005, ♀, 7 June 2005, ovipositing in beetle hole, ♀; same location but transluc[ent][sic] mini sticky trap [trap # excluded], nr. downed *Populus tremuloides*, 46°31.40'N 84°24.40'W, K. N. Barber, 21 May–7 June 2005, ♀, 7–22 June 2005, ♂, 4♀, 22 June–8 July 2005, ♀, 8–22 July 2005, 2♀; SSMarie, Sault Coll[ège] Outdoor Lab, 46°32.06'N 84°18.35'W, pooter, old *Populus* slash, K. N. Barber, 13 July 2004, ♀, 16 July 2004, on *Aralia nudicaulis* nr. old *Populus* slash, ♀; SSMarie, Finn Hill, pooter, aspen trunks, 46°31.53'N 84°17.31'W, K. N. Barber, 12 June 2005, 2♂, ♀, 13 June 2005, 2♂, 2♀; ~6.1 km SE Shabagua Corners, 8 June–13 July 2004, opaque mini sticky traps, mostly *P. tremuloides*, 48°34.8'N 89°49.2'W, M. Francis, 3♂, 5♀; The Shoals P[rovincial] P[ark], Prairie Bee, 17 June 2004, pooter, seasoned downed *Populus*, 47°52.29'N 83°53.62'W, K. N. Barber, ♀ (DEBU #01500192); ~95 km NNE Thessalon, Hwy #129, 18 June 2004, pooter, *Populus* trunks, K. N. Barber, 47°05.00'N 83°09.40'W, ♂, 5♀, 47°05.05'N 83°09.43'W, ♂, 4♀; ~11.4 km N Wawa, Hwy #17, 6 July 2004, pooter, fresh *Populus* log, 48°04.26'N 84°48.45'W, K. N. Barber, ♀; White River, St. Basil's School, 16 June 2004, pooter, standing *Populus* trunks, 48°35.58'N 85°16.72'W, K. N. Barber, ♂, ♀ (all DEBU); 27 km SSW White River, boreal mixedwood, opaque sticky trap, S. B. Holmes, [trap # excluded], 25 June–16 July 2002, B1 S3, 48°21.0'N 85°20.7'W, 2♀, B1 S4, 48°21.1'N 85°20.7'W, 2♀, B1 S5, 48°21.2'N 85°20.7'W, ♀, B1 S8, 48°21.0'N 85°20.8'W, 2♀, 16 July–7 August 2002, B1 S6, 48°21.2'N 85°20.9'W, ♂, ♀, 26 May–16 June 2003, B1 S1, 48°21.1'N 85°20.5'W, ♂; as above but 30 km SSW White River, 25 June–18 July 2002, B2 S3, 48°19.5'N 85°20.7'W, 2♂, 17♀, B2 S4, 48°19.7'N 85°21.0'W, 2♂, 4♀, B2 S6, 48°19.6'N 85°21.2'W, ♀, 16 June–7 July 2003, B2 S3, ♂, ♀, B2 S4, 3♀, 7–28 July 2003, B2 S4, ♀; as above but 37 km SSW White River, 26 June–16 July 2002, B4 S1, 48°16.5'N 85°23.3'W, 9♀, B4 S3, 48°16.4'N 85°23.6'W, 2♀, B4 S4, 48°16.2'N 85°23.3'W, 3♀, B4 S6, 48°16.4'N 85°23.2'W, 2♀, B4 S7, 48°16.4'N 85°23.1'W, ♂, 5♀, 27 May–17 June 2003, B4 S3, 2♀, B4 S7, 2♂, 17 June–8 July 2003, B4 S1, ♀, B4 S3, 3♂, 2♀, 8–29 July 2003, B4 S3, 48°16.4'N 85°23.6'W, ♀ (all DEBU); as above but 38 km SSW White River, 24 June–17 July 2002, B5 S1, 48°15.1'N 85°23.8'W, 7♂, 8♀ (CNCI), B5 S3, 48°15.2'N 85°23.6'W, 2♀, B5 S5, 48°15.2'N 85°23.9'W, ♂, 7♀, B5 S8, 48°15.3'N 85°24.0'W / 48°15.3'N 85°23.9'W, 3♀, B5 S9, 48°15.3'N 85°23.9'W, ♀, 17 July–8 August 2002, B5 S1, ♀, 27 May–17 June 2003, B5 S5, ♀, B5 S9, ♀, 17 June–8 July 2003, B5 S5, 2♀, B5 S9, ♀; as above but 40 km SSW White River, 25 June–19 July 2002, B6 S1, 48°13.9'N 85°22.2'W, 12♀, B6 S2, 48°14.0'N 85°22.1'W, ♀ (all DEBU), B6 S3, 48°14.0'N 85°22.0'W, 4♂, 19♀ (EMUS), B6 S4, 48°14.1'N 85°22.0'W, 15♀, B6 S6, 48°14.0'N 85°22.3'W, 2♀, B6

S7, 48°14.1'N 85°22.4'W, 3♂, ♀, B6 S8, 48°14.1'N 85°22.4'W, ♀, B6 S9, 48°14.2'N 85°22.1'W, 2♂, 8♀, 19 July–9 August 2002, B6 S3, ♀, 27 May–17 June 2003, B6 S2, ♀, B6 S4, ♂, 17 June–8 July 2003, B6 S1, ♀, B6 S4, 3♀, B6 S7, ♂, 2♀; as above but multi-colour sticky trap, K. N. Barber, [trap # excluded], 29 May–12 June 2003, B6 S1, 48°13.9'N 85°22.2'W / 48°14.0'N 85°22.2'W, 2♂, 4♀, B6 S3, 48°14.0'N 85°22.0'W / 48°14.1'N 85°22.0'W, 3♂, 9♀ (all DEBU), B6 S4, 48°14.1'N 85°22.0'W, 4♂, 8♀ (GLFC), B6 S9, 48°14.2'N 85°22.1'W / 48°14.2'N 85°22.2'W / 48°14.3'N 85°22.1'W, 19♂, 10♀, 12–16 June 2003, B6 S1, 4♂, 5♀, B6 S3, 2♂, 19♀, B6 S4, 4♂, 15♀, B6 S9, 19♂, 12♀, 16–26 June 2003, B6 S1, 17♂, 17♀ (all DEBU), B6 S3, 31♂, 60♀ (AMNH, CNCI, USNM), B6 S4, 14♂, 46♀, B6 S9, 69♂, 29♀, 26 June–10 July 2003, B6 S1, 6♀, B6 S3, 3♂, 21♀, B6 S4, 4♂, 27♀, B6 S9, 8♂, 10♀, 10–23 July 2003, B6 S1, 4♀, B6 S3, ♂, 6♀, B6 S4, ♂, 8♀, B6 S9, 2♂, 2♀; 25 June–9 July 2003, B6 S3, 48°14.04'N 85°21.99'W, 2♂, 10♀, 48°14.07'N 85°21.98'W, ♂, 26♀; as above but Malaise trap, B6 S3A, 48°14.06'N 85°21.97'W, 29 May–11 June 2003, ♀, 11–24 June 2003, 10♀, B6 S3B, 48°14.08'N 85°22.02'W, 13–24 June 2003, ♀, B6 S3C, 48°14.05'N 85°21.98'W, 14–24 June 2003, ♂, 15♀, 24 June–7 July 2003, 2♀, B6 S4, 48°14.13'N 85°22.01'W, 11–24 June 2003, ♂, ♀, 24 June–7 July 2003, 2♀, B6 S9, 48°14.23'N 85°22.15'W, 11–24 June 2003, ♀; as above but B6 S4, 48°14.14'N 85°22.02'W, pooter, on downed *Populus* trunk, 24 June 2003, 3♂, 13♀, 7 July 2003, ♀; as above but B6 S3, 48°14.05'N 85°21.98'W, 7 July 2003, on opaque plastic on ground, ♀; as above but B6 S9, 48°14.23'N 85°22.16'W, 16 June 2003, pooter, base of dead *Populus*, ♀, 24 June 2003, on white net on ground, pooter, ♀ (all DEBU). **Québec.** La Ferme, A. Robert, 11 July 1943, ♀, 16 July 1943, ♂ (CNCI). **UNITED STATES, Michigan: Charlevoix Co.,** ~13 km S Petoskey, Hwy. 131, 20 June 2005, pooter, live aspen trunk along railway, 45°14.40'N 84°54.97'W, K. N. Barber, ♀; **Chippewa Co.,** S[ault] S[te.] Marie, Lake Superior St[ate] U[niversity], 4 June 2005, pooter, K. N. Barber, 46°29.36'N 84°22.09'W, live aspen trunk, ♀, dead aspen snag, 2♀, 46°29.31'N 84°22.06'W, downed aspen top, ♀; **Emmet Co.,** Mackinaw St[ate] For[est], Linsley Rd. nr. Jct. Hwy. 31, 20 June 2005, pooter, live aspen trunk, 45°43.44'N 84°44.73'W, K. N. Barber, ♀ (all DEBU). **Utah:** Cache Co., Logan Canyon, Twin Creek, 15–22 July 1988, W. J. Hanson, ♀; Cache Co., Mendon Cold Spring, 20 June–4 July 1977, Malaise trap, ♂, 3♀; Cache Co., Tony Grove Creek, 29 June–8 July 1994, W. J. Hanson, ♀ (all EMUS); Utah Co., 4 mi N Aspen Grove, “1–XIII–1975” [sic 1.viii.1975?], *Populus tremuloides* infested with *Procryphalus mucronatus*, J. L. Petty, ♀, [additional label reading:] *Populus tremuloides* infested with *Trypophloeus populi*, 2♀ (CNCI).

**Other Material Examined (damaged): CANADA, Ontario:** ~14 km W Cochrane, 7 June–9 July 2004, opaque mini sticky traps, mostly *P. tremuloides*, 49°03.1'N 81°12.1'W, L. Rowlinson, 4♀; ~35 km WSW Dubreuilville, 1.8 km W Jct. Hwys. #17 & #519, 15 June–6 July 2004, boreal mixedwood, opaque mini sticky traps, 48°17.46'N 84°54.08'W, K. N. Barber, 2♀; ~6.1 km SE Shabaqua Corners, 8 June–13 July 2004, opaque mini sticky traps, mostly *P. tremuloides*, 48°34.8'N 89°49.2'W, M. Francis, 3♀; 27 km SSW White River, boreal mixedwood, opaque sticky trap, S. B. Holmes, [trap # excluded], 25 June–16 July 2002, B1 S5, 48°21.2'N 85°20.7'W, ♀, 16 June–7 July 2003, B1 S1, 48°21.1'N 85°20.5'W, ♀; as above but 30 km SSW White River, 25 June–18 July 2002, B2 S3, 48°19.5'N 85°20.7'W, 5♀, B2 S4, 48°19.7'N 85°21.0'W, ♀, 16 June–7 July 2003, B2 S4, 2♀; as above

but 37 km SSW White River, 26 June–16 July 2002, B4 S4, 48°16.2'N 85°23.3'W, 3♀, B4 S7, 48°16.4'N 85°23.1'W, 3♀, B4 S8, 48°16.3'N 85°23.2'W, ♀, 17 June–8 July 2003, B4 S3, 48°16.4'N 85°23.6'W, ♂; as above but 38 km SSW White River, 24 June–17 July 2002, B5 S1, 48°15.1'N 85°23.8'W, ♀, B5 S5, 48°15.2'N 85°23.9'W, ♀; as above but 40 km SSW White River, 25 June–19 July 2002, B6 S1, 48°13.9'N 85°22.2'W, 3♀, B6 S3, 48°14.0'N 85°22.0'W, 12♀, B6 S4, 48°14.1'N 85°22.0'W, ♀, B6 S6, 48°14.0'N 85°22.3'W, 2♀, B6 S9, 48°14.2'N 85°22.1'W, ♂, ♀, 19 July–9 August 2002, B6 S4, ♀, 17 June–8 July 2003, B6 S1, ♂, B6 S4, ♂, ♀, B6 S7, 48°14.1'N 85°22.4'W, 2♂, 8–29 July 2003, B6 S4, ♀; as above but multi-colour sticky trap, K. N. Barber, [trap # excluded], 29 May–12 June 2003, B6 S1, 48°13.9'N 85°22.2'W / 48°14.0'N 85°22.2'W, ♂, B6 S3, 48°14.0'N 85°22.0'W / 48°14.1'N 85°22.0'W, ♀, 12–16 June 2003, B6 S1, 2♂, B6 S4, 48°14.1'N 85°22.0'W, ♀, B6 S9, 48°14.2'N 85°22.1'W / 48°14.2'N 85°22.2'W / 48°14.3'N 85°22.1'W, 2♂, 16–26 June 2003, B6 S1, 4♂, B6 S3, 3♂, 6♀, B6 S4, 4♂, 4♀, B6 S9, 10♂, 9♀, 26 June–10 July 2003, B6 S1, 2♀, B6 S3, ♀, B6 S4, 2♀, B6 S9, 2♀, 10–23 July 2003, B6 S3, 2♀; as above but 25 June–9 July 2003, B6 S3, 48°14.0'N 85°22.0'W, ♀ (all DEBU).

### Etymology

This remarkable new species is named in honour of David H. Pengelly, a friend and influential mentor. Dave introduced me to the beauty and diversity of the Insecta and offered the insight that there was more to the animal world than vertebrates. His encouragement and support were unlimited and led to a student curatorial appointment at the University of Guelph's collection with focus on the acalyprate flies. Dave also arranged my first visit to the CNCI where I met renowned dipterists and deepened my knowledge of flies. This support was expanded as I entered into a M.Sc. program under his primary tutelage along with Frank McAlpine and then Steve Marshall. A mix of taxonomy and life history was a common feature of Dave Pengelly's approach to entomology and is reflected in the approach taken in the current paper. During retirement, Dave and Fran Pengelly were always welcoming hosts for visitors to their home outside Erickson, Manitoba—a location where I first collected numerous *Strongylophthalmyia* and *Tanypeza* together. There I took great pleasure and pride in introducing my two children to a man that had such a profound influence on my life. Thank you “D. H.”

### Distribution

*S. pengellyi* is known from New Brunswick, Québec, Ontario, Michigan, and Utah. The other Nearctic species, *S. angustipennis*, ranges from British Columbia to Nova Scotia, and south to Wyoming, Michigan, and Massachusetts (Shewell 1965). Based on material examined during this study, California, Utah, and Arizona are added here as new state records. Both species apparently show a northern, transcontinental range within the range of trembling aspen.

### Relationships

Published descriptions of the many species of *Strongylophthalmyia* lack sufficient detail for an adequate analysis of phylogenetic relationships. Shatalkin (1996) recognizes two species groups in the genus: the *crinita*-group (6 species mostly Oriental: India, Burma, Thailand, Vietnam, Taiwan, Japan) defined by the presence of modified epandrial processes

in the males and sexual dimorphism in the palpi, and the *punctata*-group (9 species mostly Oriental: Thailand (including *S. thaii*), Vietnam, Philippines, Taiwan, Russia (Khabarovsk and Maritime Territories)) defined mostly by a dorsal expansion of flagellomere 1 in the male.

None of the defining apomorphies of these putative species groups is found in *S. pengellyi*, *S. angustipennis*, or in the Palaearctic *S. ustulata* and *S. pictipes*, all four species associated with aspen. Along with *S. japonica* Iwasa (Japan, Russia) and *S. caliginosa* Iwasa (Japan), these six species may represent a monophyletic group based on the putative synapomorphy of a haired arista (bare arista in *Nartshukia* and other *Strongylophthalmyia*). Additionally, the former four species share a basally narrowed and apically rounded surstylus. Further, *S. angustipennis* and *S. ustulata* both have mostly pale setae on the head and thorax and numerous elongate fine setae on the lateroventral surface of the front coxae in the male. These putative synapomorphies suggest a sister relationship between these two species (condition of front femur of male not known by author for *S. pictipes*). *Strongylophthalmyia pengellyi* and *S. pictipes* can each be distinguished from their regional counterpart by the shorter hairing on the arista but the phylogenetic interpretation of this putative synapomorphy as well as the structure of the distiphallus in all six species requires further study.

### Biology of *Strongylophthalmyia*

#### Flight period

Table 1 summarizes four sets of capture data for *Strongylophthalmyia* species from sticky traps set in White River and Sault Ste. Marie, ON. According to these data, the flight period of *S. pengellyi* in Ontario appears to be from at least 7 June to 22 July. However, additional field records are as early as 31 May (Sault Ste. Marie, ON) and as late as 1 August (Aspen Grove, UT).

The collections made with large and mini sticky traps represent the only continuous collection data available. All four sets of data similarly indicate that adults of *S. pengellyi* emerge and fly slightly earlier than *S. angustipennis*. Unlike the former, *S. angustipennis* clearly continues to be active as adults through the season until early September which may indicate at least a partial second generation or a protracted emergence. For both species, more females than males were captured.

Six Malaise traps yielded a total of 2 male and 33 female *S. pengellyi* over roughly the same period (29 May to 22 July 2003) as the coloured mini sticky traps (29 May to 23 July 2003) but were prone to disruption by bears. This trapping method also showed a clearly defined peak (2 males, 28 females) during the second sampling period (11-24 June 2003). Captures of *S. angustipennis* began modestly in the second period (1 male, 2 females) and a total of 18 males and 16 females were accumulated by 22 July. Malaise traps collected equivalent numbers of each species of *Strongylophthalmyia* (35:34) compared to about a 12:1 ratio (579:47) in favour of *S. pengellyi* with the coloured mini sticky traps.

#### Captures from mini sticky traps

Table 2 summarizes the captures for *S. pengellyi* on the coloured mini sticky traps. No significant differences were attributable to height above ground for captures of

TABLE 1. Captures of adult *Strongylophthalmyia* spp. with sticky traps near White River (2002, 2003) and in Sault Ste. Marie (2005), Ontario.

## White River, Ontario

2002 – 90 poles (3 m) ~3-week periods beginning:

Translucent large boards		24-Jun	16-Jul	7-Aug	27-Aug	Total
<i>S. pengellyi</i>	Male	24	1	0	0	25
	Female	169	4	0	0	173
	Total	193	5	0	0	198
<i>S. angustipennis</i>	Male	2	12	16	33	63
	Female	3	30	36	37	106
	Total	5	42	52	70	169

2003 – 36 poles (3 m) 3-week periods beginning:

Translucent large boards		26-May	16-Jun	7-Jul	28-Jul	18-Aug	8-Sep	Total
<i>S. pengellyi</i>	Male	9	24	0	0	0	0	33
	Female	9	25	5	0	0	0	39
	Total	18	49	5	0	0	0	72
<i>S. angustipennis</i>	Male	0	1	2	0	1	0	4
	Female	0	4	7	3	3	1	18
	Total	0	5	9	3	4	1	22

2003 – 24 poles (3 m) 2-week periods beginning:

Coloured <sup>1</sup> mini boards		29-May	12-Jun	26-Jun	10-Jul	Total
<i>S. pengellyi</i>	Male	29	186	13	4	232
	Female	32	221	72	22	347
	Total	61	407	85	26	579
<i>S. angustipennis</i>	Male	0	2	8	3	13
	Female	0	3	20	11	34
	Total	0	5	28	14	47

## Sault Ste. Marie, Ontario

2005 – 6 poles (1.5 m) 14-17-day periods beginning:

Translucent mini boards		21-May	7-Jun	22-Jun	8-Jul	22-Jul	8-Aug	Total
<i>S. pengellyi</i>	Male	0	1	0	0	0	0	1
	Female	1	4	1	2	1	0	9
	Total	1	5	1	2	1	0	10
<i>S. angustipennis</i>	Male	0	1	5	0	13	23	42
	Female	0	0	12	47	62	38	159
	Total	0	1	17	47	75	61	201

<sup>1</sup> four colours (translucent, blue, white, yellow) beginning at each of 3 m- and 1.5 m-heights.

TABLE 2. Captures of adult *S. pengellyi* on coloured mini sticky boards over four trapping periods near White River, Ontario (Block 6 - 29 May to 23 July 2003).

Height <sup>1</sup>	Colour	Male					Female					Total			
		1 <sup>2</sup>	2	3	4	1-4	1	2	3	4	1-4	1	2	3	4
High	Translucent	8	71	4	0	83	4	44	17	6	71	12	115	21	6
	Blue	13	45	4	3	65	7	42	14	3	66	20	87	18	6
	White	2	18	0	0	20	4	9	6	1	20	6	27	6	1
	Yellow	0	5	2	0	7	1	3	0	1	5	1	8	2	1
All		23	139	10	3	175	16	98	37	11	162	39	237	47	14
Low	Translucent	4	29	1	0	34	9	54	21	6	90	13	83	22	6
	Blue	1	12	0	0	13	4	41	8	1	54	5	53	8	1
	White	1	5	1	1	8	3	27	5	1	36	4	32	6	2
	Yellow	0	1	1	0	2	0	1	1	3	5	0	2	2	3
All		6	47	3	1	57	16	123	35	11	185	22	170	38	12
High + Low	Translucent	12	100	5	0	117 a <sup>3</sup>	13	98	38	12	161 a	25	198	43	12
	Blue	14	57	4	3	78 b	11	83	22	4	120 a	25	140	26	7
	White	3	23	1	1	28 b	7	36	11	2	56 b	10	59	12	3
	Yellow	0	6	3	0	9 c	1	4	1	4	10 c	1	10	4	4
All		29	186	13	4	232	32	221	72	22	347	61	407	85	26

<sup>1</sup> height of top board in series of 4: "high" is 3m and "low" is 1.5m<sup>2</sup> two-week trapping periods 1-4 beginning 29 May, 12 June, 26 June, and 10 July, respectively<sup>3</sup> total catches followed by different letters within a column represent significant differences (Kruskal-Wallis tests followed by Student-Newman-Keuls multiple comparisons,  $\alpha=0.05$ ,  $n=24$ )

males ( $P=0.120$ ; despite apparently larger captures in the high boards—175 vs. 57), females ( $P=0.331$ ), or both genders combined ( $P=0.910$ ).

Comparing the captures by colour, irrespective of height (Table 2, high+low), uncovered highly significant differences for males, females, and both genders combined ( $P<0.001$ ). Trap catches decreased in the following order: translucent > blue > white > yellow. Translucent boards captured significantly more males and total flies than coloured boards, while females were captured in similar numbers as on blue boards. The side-by-side comparison of translucent and blue boards (6 poles each at 1.5 m above ground) yielded 28 *S. pengellyi* (3 males, 25 females) on translucent boards and only 12 females on blue boards.

Based on these results, only short poles (1.5 m with 4 boards) and only translucent mini sticky boards were used in 2004 and 2005. All but the Mattawa site (5 of 6), yielded captures of at least one specimen of *S. pengellyi* for a group of six poles over sample periods ranging from 20 to 35 days (2004). Capture data for Sault Ste. Marie are listed in Table 1 (96 days; 2005). Sticky traps of the design used in this study are an efficient option for assessing an area for the presence of this otherwise cryptic fly. It is possible that the translucent Coroplast boards more closely resemble the pale bark of trembling aspen trees.

### Adult feeding, oviposition, and ecological relationships

Almost all adults of *S. pengellyi* were collected on aspen trunks with bark still firmly attached or on recently downed logs or large branches. Very few specimens were collected by sweeping on surfaces near downed aspen. Late stages of decomposed aspen logs did not appear to be attractive to either species of *Strongylophthalmyia*. While also found in similar locations, *S. angustipennis* is more often found perching and copulating on the leaves of the herb and shrub layer. Shatalkin (1993) describes similar observations of a pair of Palaearctic species known to be associated with aspen: “Unlike *S. ustulata*, which usually occurs on leaves, *S. pictipes* prefers fallen trunks and stumps, on which it is most often captured”. There is a striking parallel to the field observations made on the two Nearctic species.

Oviposition by *S. pengellyi* was never observed but females were often seen “probing” irruptions on the bark of aspen with the ovipositor (Fig. 23). These irruptions included uplifted areas where spore tendrils of *Cytospora* spp. fungi perforated the bark. The same irruptions were often “tasted” with the labellum (similar to Fig. 22) by both genders. Though not quantified in any way, there was an evident prevalence of bleeds caused by these pathogenic fungi as well as by *Entoleuca mammata* (Wahlenberg: Fr.) J. D. Rogers & Y.-M. Ju on the trees, snags, and downed logs and branches of aspen stands yielding adults of *S. pengellyi*. Small bleeds were attractive to both species of fly.

One female *S. pengellyi* was observed backing into a (scolytid?) beetle hole for an extended period of time with her ovipositor greatly extended (Fig. 24). There was also another observation of a female orienting to a beetle hole and walking “excitedly” sideways in an arc with its head oriented to the hole at about a 2 cm distance (Dubreuilville—2005). Both holes were too large to be produced by the scolytid *Procryphalus mucronatus* (LeConte), which was reared from aspen branches (Dubreuilville—2003; first record for Ontario, D. E. Bright, pers. comm.; vouchers deposited at CNCI and GLFC). The holes were more likely made by *Trypodendron retusum* (LeConte). *Trypophloeus populi* Hopkins has not yet been recorded from Ontario or Québec (Wood 1982; Bright 1976).

These latter observations suggest an association of Nearctic *Strongylophthalmyia* with scolytids. The three specimens of *S. pengellyi* from Aspen Grove, Utah were collected on aspen trees attacked by *P. mucronatus* with two indicating the presence of *T. populi* as well. Of the two species of scolytids studied by Petty (1977), *P. mucronatus* is likely too small to produce tunnels or exit holes that would allow adults of *S. pengellyi* to emerge. But since this smaller scolytid is considered to be secondary to attacks by other beetles such as *T. populi* (Petty 1977), emergence exits for flies are not likely to be limited. In this study, I encountered only *T. retusum* (Dubreuilville, including one reared specimen, Sault Ste. Marie, ON, and Sault Ste. Marie, MI), a species also recorded by Petty (1977) from trees attacked by *P. mucronatus*.

Many other insects, especially Diptera (Cecidomyiidae, Dolichopodidae, Empididae, Lonchaeidae, Otitidae, Clusiidae, Odiniidae, Aulacigastridae) and Coleoptera (especially Nitidulidae, Staphylinidae) were encountered on the same aspen surfaces as *S. pengellyi*. Adult *Tachypeza* spp. (Empididae) were often mistaken for *S. pengellyi* but the former have a much faster, erratic movement. Both types of flies might be mistaken for ants by a casual non-entomologist observer.

### **Larval habitat**

A total of 22 larvae of *Strongylophthalmyia* were obtained from the early collection of aspen bark held in emergence pails (20 May 2005). Eleven of these pupariated and eight produced adults of *S. angustipennis* (6 males, 2 females: formation of puparia 24-27 May; adult emergence 11-15 June). The second collection (2 June 2005) yielded two more larval specimens and 14 adults (10 males, 4 females, adult emergence from 16-29 June 2005) of *S. angustipennis*.

With no evidence to the contrary, it is likely that all the larval specimens that either died or were preserved are also *S. angustipennis* and that the microhabitat of *S. pengellyi* was missed during the sampling. It is nonetheless presumed that both Nearctic species of *Strongylophthalmyia* overwinter as mature or nearly mature larvae under the bark of trembling aspen.

This is the first record of the larva of *S. angustipennis*. It is characterized by biramous anterior spiracles as described for *S. ustulata* (Krivoshchina 1984) and for *Tanypeza longimana* Fallén (Foote 1970). No other descriptions of *Strongylophthalmyia* larvae are available but this suggests that biramous anterior spiracles are a groundplan feature of the Strongylophthalmyiidae.

### **Movements of wings and abdomen**

Both species of *Strongylophthalmyia* were often seen on the same aspen log (White River, Block 6 Site 4). Interactions between genders and species of *Strongylophthalmyia* often involved abrupt forward movements of one or usually both wings. This behaviour was vigorous between females and particularly between male and female (male-male interactions were rarely observed) usually involving runs directed by the female at the circling male.

One observation of a group of *S. pengellyi*, numbering about 8 specimens of mixed gender, was made on a small aspen tree of about 20 cm diameter (DBH) (Thessalon). These flies were very actively running and confined to an area of about 10-12 cm diameter at a

height of about 3 m. Although no copulations were observed, one-on-one interactions were frequent. Clusters of mixed gender may be more common at greater heights than generally accessible to an observer. At lower heights, mostly individual females are observed, which are possibly already mated and are searching for oviposition sites.

In the laboratory, captive flies in Petri plates of both genders were seen to bob and vibrate the abdomen in a vertical plane. This was usually associated with forward wing movements but more generally with agitation or excitement when orienting to each other. Males also occasionally arch the abdomen upward which is likely required to remove the elongate aedeagus from the genital pouch as suggested by Shatalkin (1993).

### Mating behaviour

Observations supported by photographs were made on copulating pairs of *S. angustipennis* in Petri plates. The male uses the hind trochanters and bases of the hind femora to squeeze the female ovipositor laterally at the base of the oviscape (segment 7). The male hind tibiae are tightly appressed to each other and flexed against the hind femora which brings the apices of the tibiae up against the posteroventral surface of the female sternite 6. The apices of the mid tibiae may rest dorsolaterally on the female abdomen in the vicinity of segment 4 with the mid tarsi dangling down from the sides of her abdomen. The front tibiae reach over the wing base of the female and the tarsi drape over the scutal / pleural area toward the postpronota or the front coxae of the female. The male sternites may flex along the medial concave weakening to assist in stabilizing the female abdomen in a medial position. This surface is tightly appressed to the female ovipositor as the female abdomen is flexed upward at nearly 90° between segments 6-7.

Though only seen once fleetingly under magnification, the posture of *S. pengellyi* is very similar except the curvature of the mid basitarsus allows it to wrap more conformingly to the contour of the female abdomen and only the apical four segments of the tarsus dangle down. No functional explanation for the modifications of the male front tarsus was noted. Males were never observed to use their legs in any obvious courtship display. The male of *S. pengellyi* was also seen to bring the wings forward at about a 45° angle anteroventrally toward the female's head (Fig. 21) on each of two occasions when copulatory attempts were observed. This may allow the female to see the black spot on the wing of the male as has been suggested recently for a dolichopodid with a similar behaviour (Satô 2006). Such ornamentation of the wing, or "badge" sensu Zimmer et al. (2003), is common in the Diptera but the location in *S. pengellyi* is at least unusual if not unique. During the many prolonged copulations observed of *S. angustipennis*, the male flexed the wings to such a position less frequently and only briefly.

Internally, as observed in one cleared preparation of an *in copula* pair of *S. angustipennis*, the acrophallus reaches the anteroventral vaginal sclerite of the female, the tips of the "hooks" reaching the level of the ventral receptacle. Though located within segment 6 in this preparation, these structures of the female would likely have to be located, at least temporarily, within the oviscape (segment 7) before the male squeezes the oviscape with its hind legs.

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## References

- Barraclough, D. A. 2000. The identity of *Strongylophthalmyia* Heller species (Diptera: Schizophora: Strongylophthalmyiidae) described from the Afrotropical Region, and their transfer to the family Clusiidae. *Annals of the Natal Museum* 41: 103–106.
- Bright, D. E., Jr. 1976. The insects and arachnids of Canada. Part 2. The bark beetles of Canada and Alaska, Coleoptera: Scolytidae. Biosystematics Research Institute, Research Branch, Canada Department of Agriculture, Ottawa, Ontario. 241 pp.
- de Meijere, J. C. H. 1914. Studien über südostasiatische Dipteren. IX. *Tijdschrift voor Entomologie* 57: 137-168, 169-275, pls. 5–7.
- Evenhuis, N. L. 1989. 58. Family Strongylophthalmyiidae. p. 472 *In* Catalog of the Diptera of the Australasian and Oceanian Regions. Bishop Museum Special Publication 86. N. L. Evenhuis (ed.), Bishop Museum Press and E. J. Brill, Honolulu. 1155 pp.
- Evenhuis, N. L. and G. A. Samuelson. 2006. Abbreviations for Insect and Spider Collections of the World. Bishop Museum, Honolulu. <http://hbs.bishopmuseum.org/codens/codens-inst.html> (page last accessed 30 December 2006).
- Foote, B. A. 1970. The larvae of *Tanypeza longimana* (Diptera: Tanypezidae). *Annals of the Entomological Society of America* 63: 235–238.
- Frey, R. 1956. Studien über ostasiatische Dipteren. V. Psilidae, Megamerinidae. *Notulae Entomologicae* 35 (1955): 122–137.
- Griffiths, G. C. D. 1972. The phylogenetic classification of the Diptera Cyclorrhapha, with special reference to the structure of the male postabdomen. *Series Entomologica*, 8. Dr. W. Junk, N. V., The Hague. 340 pp.
- Heller, K. M. 1902. *Strongylophthalmyia* nom. nov. für *Strongylophthalmus* Hendel. *Wiener Entomologische Zeitung* 21: 226.
- Hendel, F. 1902. *Strongylophthalmus*, eine neue Gattung der Psiliden (Dipt.). *Wiener Entomologische Zeitung* 21: 179–181.

- Hennig, W. 1940. Aussereuropäische Psiliden und Platystomiden im Deutschen Entomologischen Institut (Diptera). Arbeiten über Morphologische und Taxonomische Entomologie aus Berlin-Dahlem 7: 304–318.
- Hennig, W. 1941. 41. Psilidae. In Die Fliegen der Palaearktischen Region, Vol. 5, Lieferung 140, E. Lindner (ed.), Schweizerbart, Stuttgart. 38 pp.
- Hennig, W. 1958. Die Familien der Diptera Schizophora und ihre phylogenetischen Verwandtschaftsbeziehungen. Beiträge zur Entomologie 8: 505–688.
- Iwasa, M. 1992. The genus *Strongylophthalmyia* Heller (Diptera, Strongylophthalmyiidae) from Japan, with descriptions of two new species. Japanese Journal of Entomology 60: 660–666.
- Iwasa, M. 1998. 3.10. Family Strongylophthalmyiidae. pp. 173–175 In Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). Vol. 3, Higher Brachycera. L. Papp and B. Darvas (eds.), Science Herald, Budapest. 978 pp.
- Krivosheina, N. P. 1981. New Palearctic species of Diptera of the genus *Strongylophthalmyia* Hell. (Diptera, Strongylophthalmyiidae). Entomological Review 60: 162–165 (originally published in 1981, Entomologicheskoe Obozrenie 60: 183–186).
- Krivosheina, N. P. 1984. Family Strongylophthalmyiidae. pp. 27–28 In Catalogue of Palaearctic Diptera. Vol. 9. Micropezidae–Agromyzidae. Á. Soós and L. Papp (eds.), Akadémiai Kiadó, Budapest. 460 pp.
- McAlpine, D. K. 1997. Gobryidae, a new family of acalyptrate flies (Diptera: Diopsoidea), and a discussion of relationships of the diopsoid families. Records of the Australian Museum, 49: 167–194.
- McAlpine, J. F. 1981. Morphology and terminology – adults. pp. 9–63 In Manual of Nearctic Diptera. Vol. 1. J. F. McAlpine, B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D.M. Wood (coordinators), Research Branch, Agriculture Canada, Monograph No. 27. pp. 1–674.
- McAlpine, J. F. 1989. Phylogeny and classification of the Muscomorpha. pp. 1397–1518 In Manual of Nearctic Diptera. Vol. 3. J. F. McAlpine (ed.) and D. M. Wood. Research Branch, Agriculture Canada, Monograph No. 32. pp. 1333–1581.
- Mosley, E., S. B. Holmes, and E. Nol. 2006. Songbird diversity and movement in upland and riparian habitats in the boreal mixedwood forest of northeastern Ontario. Canadian Journal of Forest Research 36: 1149–1164.
- Motschulsky, V. de. 1860. Coléoptères rapportés de la Sibirie orientale et notamment des pays situés sur les bords du fleuve Amour par MM Schrenck, Maack, Ditmar, Voznessensli, etc. In Band 2, Lieferung 2. Coleopteren. L. von Schrenck. Reisen und Forschungen im Amur-lande. pp. 80–257 + 1p. [Errata] + pls VI–XI +[XII–1860].
- Papp, L., B. Merz, and M. Földvári. 2006. Diptera of Thailand. A summary of the families and genera with references to the species representations. Acta Zoologica Academiae Scientiarum Hungaricae 52: 97–269.
- Petty, J. L. 1977. Bionomics of two aspen bark beetles, *Trypophloeus populi* and *Procryphalus mucronatus*. The Great Basin Naturalist 37: 105–127.
- Roháček, J. 1998. 3.9. Family Tanypezidae. pp. 165–171 In Contributions to a Manual of Palaearctic Diptera (with special reference to flies of economic importance). L.

- Papp and B. Darvas (eds.), Vol. 3, Higher Brachycera. Science Herald, Budapest. 978 pp.
- Satô, M. 2006. The use of acute and marked wings in the copulatory courtship behaviour of *Hercostrabus* sp. (Dolichopodidae). p. 219. In 6th International Congress of Dipterology, Suwa, M. (ed.), 23-28 September 2006, Fukuoka, Japan, Abstract Volume, 354 pp.
- Shatalkin, A. I. 1993. Taxonomy of flies of the family Strongylophthalmyiidae (Diptera). Entomological Review 73(6) [1994]: 155–161. (originally published in 1993, Zoologicheskii Zhurnal 72(10): 124–131).
- Shatalkin, A. I. 1996. New and little known species of flies of Lauxaniidae and Strongylophthalmyiidae (Diptera). Russian Entomological Journal 4(1995): 145–157.
- Shewell, G. E. 1965. Family Psilidae. pp. 638–641 In A catalog of the Diptera of America north of Mexico. A. C. Stone, C. W. Sabrosky, W. W. Wirth, R. H. Foote, and J. R. Colson (eds.), U.S. Department of Agriculture, Agriculture Research Service, Agriculture Handbook 276. 1696 pp.
- Steyskal, G. C. 1968. Family Richardiidae. In A catalogue of the Diptera of the Americas south of the United States. N. Papavero (ed.), Departamento de Zoologia, Secretária da Agricultura, São Paulo. Fasc. 53. 26 pp.
- Steyskal, G. C. 1971. Notes on the genus *Strongylophthalmyia* Heller, with a revised key to the species (Diptera: Strongylophthalmyiidae). Annals of the Entomological Society of America 64: 141–144.
- Steyskal, G. C. 1987a. Tanypezidae. pp. 773–776 In Manual of Nearctic Diptera. Vol. 2. J. F. McAlpine (ed.), B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood. Research Branch, Agriculture Canada, Monograph No. 28. pp. 675–1332.
- Steyskal, G. C. 1987b. Strongylophthalmyiidae. pp. 777–779 In Manual of Nearctic Diptera. Vol. 2. J. F. McAlpine (ed.), B. V. Peterson, G. E. Shewell, H. J. Teskey, J. R. Vockeroth, and D. M. Wood. Research Branch, Agriculture Canada, Monograph No. 28. pp. 675–1332.
- Wood, S. L. 1982. The bark and ambrosia beetles of North and Central America (Coleoptera: Scolytidae), a taxonomic monograph. Great Basin Naturalist Memoir No. 6, Brigham Young University, Provo, Utah. 1359 pp.
- Yang, J. and X. Wang. 1992. A primary study on Psilidae and Strongylophthalmyiidae of Mt. Mogan with two new species (Diptera: Acalyptera). Journal of Zhejiang Forestry College 9: 446–449.
- Zetterstedt, J. W. 1847. Diptera Scandinaviae. Disposita et descripta 6: 2163–2580. (*Chyliza*: p.2427–2428).
- Zimmer, M., O. Diestelhorst, and K. Lunau. 2003. Courtship in long-legged flies (Diptera: Dolichopodidae): function and evolution of signals. Behavioral Ecology 14: 526–530.



FIRST NEW WORLD RECORD OF *DISCOMYZA INCURVA*  
(FALLÉN) FROM SOUTHERN ONTARIO, WITH A KEY TO NEW  
WORLD *DISCOMYZA* MEIGEN (DIPTERA: EPHYDRIDAE)

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Mathis and Zatwarnicki (2005) recently revised the New World species of *Discomyza* Meigen including two species, the native *D. u-signata* Cresson (Texas), and the widespread, originally Oriental *D. maculipennis* (Wiedemann) (California, Florida(?), Bahamas, West Indies, Belize, Surinam, Brazil). We here record a second introduced species, *D. incurva* (Fallén) (Fig. 1), from southern Ontario (Canada). *Discomyza incurva* was previously known from the Palaearctic region only (nearly all of Europe, North Africa, Turkey, Caucasus, Israel, Jordan, and Japan; see Zatwarnicki and Mathis in press). *Discomyza* species for which immature stages are known, including *D. incurva*, are associated with dead snails (Ferrar 1987), although some species have also been reared from other kinds of invertebrate and vertebrate carrion (Bohart and Gressitt 1951; Disney 1970). Adults of the three New World species can be separated using the key below.

**Acronyms of depositories.** DEBU – Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada; CNCI – Canadian National Collection of Insects, Ottawa, Ontario, Canada.

Key to New World species of *Discomyza* Meigen

1. Wing with a broad band of infuscation from front margin to posterior crossvein and a broad apical spot in cells  $r_{2+3}$  and  $r_{4+5}$ , the two connected along front margin (Mathis and Zatwarnicki 2005: Fig. 21). Anepisternum with fine horizontal rows of silvery microtomentum. Face lacking silvery microtomentum (United States: California, Florida?; Neotropical) .....*D. maculipennis*
- Wing with more or less developed infuscation around posterior crossvein, not connected to infuscation along front margin; apex of wing clear or more or less infuscated (Fig. 1). Anepisternum either without microtomentum or microtomentum uniform and brownish. Face with or without silvery microtomentum .....2
2. Face weakly sculptured, with distinct silvery microtomentum arranged in paired paramedian lines and u- and w-shaped lateral markings (Mathis and Zatwarnicki 2005: Fig. 20); smaller setulae of face inserted immediately inside parafacials. Microtomentum present on frons, setulose portion of anepisternum, and posterior

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surface of fore femur. Apical scutellar setae closer to one another than to corresponding basal scutellar. Fore femur perfectly rounded posteroventrally, with setulae in posteroventral row more erect, neither crowded nor stronger than usual (United States: Texas) .....*D. u-signata*

- Face strongly sculptured, lacking silvery microtomentum (Fig. 2). Smaller setulae of face distinctly removed from parafacials. Microtomentum (almost) completely lacking on frons, anepisternum, and posterior surface of fore femur. Apical scutellar setae farther from one another than from corresponding basal scutellar. Apical half of fore femur posteroventrally with a rounded edge (weakly developed in female); setulae of posteroventral row more crowded (especially near middle) and strongly inclined; these setulae thickened in male (Canada: Ontario) .....*D. incurva*



FIGURE 1. *Disomyza incurva* (Fallén), male habitus (England, Devon). Scale bar 0.5 mm.

## *Discomyza incurva* (Fallén, 1823)

**Material examined.** NEARCTIC (all DEBU). **Canada:** ♂, Ontario, York Region, Woodbridge, Vaughan Mills Road at Humber River, 29 August 2005, field and river bank, sweeps, M. D. Bergeron; ♀, same as previous except 8 September 2005, field; ♀, same except 9-17 June 2006, bait trap (design see Buck 1997: Fig. 4) with dead *Cepaea* snails. PALAEARCTIC (all CNCI). **Great Britain:** 3♂, 2♀, England. **Switzerland:** ♂, Jura; ♀, Ticino. **Germany:** ♀, Hessen.

**Identification.** *Discomyza* can be identified using the key to Nearctic Ephydriidae genera by Wirth et al. (1987). *Discomyza incurva* and *D. u-signata* (Texas: ♂, ♀, DEBU) key to *Clasiopella* Hendel, not to *Discomyza*, in Mathis and Zatwarnicki's (2005) key to New World genera of Discomyzini (we have not studied *D. maculipennis*). The pseudopostocellar setae of *D. incurva* are 0.57-0.73x (n = 7) as long as the ocellar setae (Mathis and Zatwarnicki state "length considerably less than one-half that of ocellar setae"). For species level identification we used keys by Cresson (1939) and by Zatwarnicki and Mathis (in press), covering the World and the Palaearctic fauna, respectively. The genitalia of the Ontario male agree well with illustrations provided for *D. incurva* by Mathis and Zatwarnicki (l.c.). It should be noted that *D. incurva* does not key properly in Cresson's (1939) key because the wing is described as being "not twice as long as broad" (as opposed to "about twice as long as broad" for the alternative, *D. eritrea* Cresson; cf. couplet 4). According to our own measurements, the wing of *D. incurva* is 1.93-2.06x (n = 7) as long as broad (from costagial seta to apex).

**Discussion.** *Discomyza incurva* provides yet another example for the continuing influx of exotic species into North America. While some introduced species are detected early because of their economic significance, a much larger number of economically insignificant species probably escapes detection for relatively long periods of time. Because of the lack of active research on Ephydriidae in Canada, it is difficult to estimate how long *D. incurva* has been established in southern Ontario.

Unlike most other shore flies, all *Discomyza* species for which the biology is known (including *D. incurva*) breed in dead snails (Ferrari 1987; Zatwarnicki and Mathis in press). It is likely that *D. incurva* was introduced accidentally from Europe through commercial shipments that were contaminated with dead snails. The impact of the introduction of *D. incurva* on communities of native snail carrion breeding insects is probably low. In European studies dealing with insects associated with snail carrion, the species was found either in low numbers (e.g., Joswig 1985) or was absent (e.g., Beaver 1972; Buck 1997). Only two other North American Ephydriidae species outside *Discomyza* have been reported to breed in snail carrion, *Platygymnopa heliciis* Wirth (Wirth 1971), and *Athyroglossa glabra* (Meigen) (reared from dead snails in Germany by Joswig 1985). The '*Athyroglossa*?' species reared by Judd (1957) from dead pond snails (*Lymnaea palustris* Müller) in southern Ontario was later described as *Platygymnopa heliciis* (Wirth 1971). Our own snail-baited traps caught mostly Phoridae (*Puliciphora* Dahl, *Megaselia* Rondani, *Chaetopleurophora* Schmitz, *Spiniphora* Malloch) and Calypttratae besides one specimen of *Discomyza incurva*.

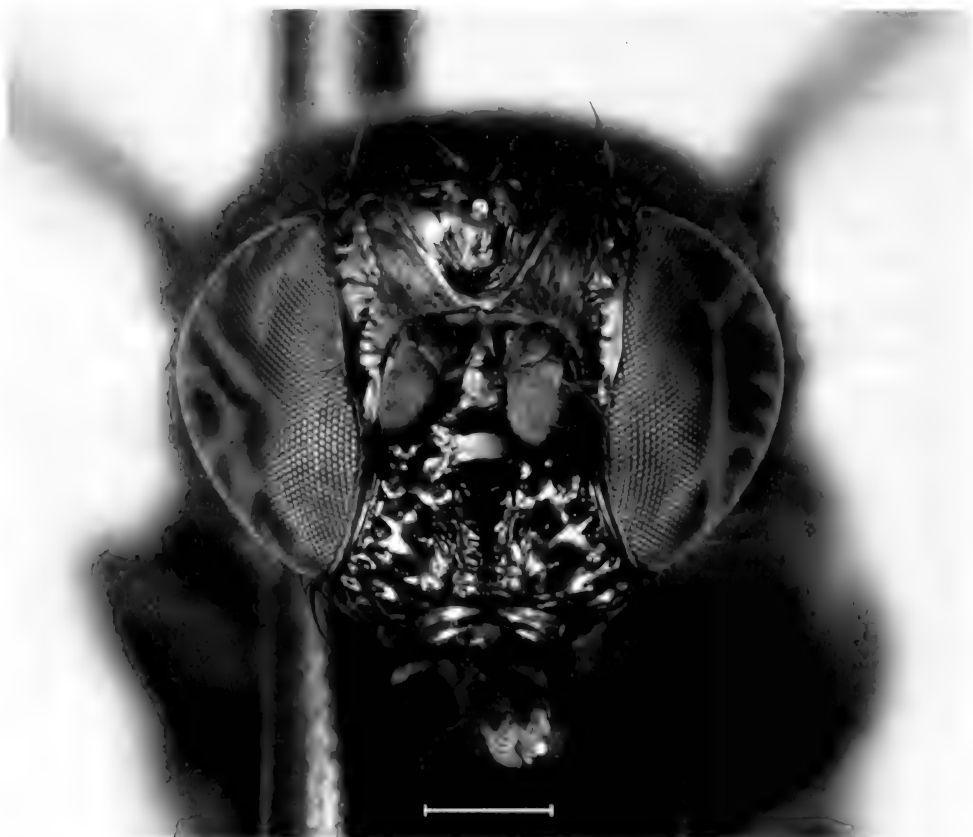


FIGURE 2. *Discomyza incurva* (Fallén), male head, frontal view (Switzerland, Jura). Scale bar 0.3 mm.

### Acknowledgements

We thank Jeff Skevington (CNCI) for the loan of European material of *Discomyza incurva*, and for permission to take photographs. Wayne N. Mathis (Smithsonian Institution, Washington, D. C., United States) and Tadeusz Zatwarnicki (University of Opole, Poland) are thanked for comments on the manuscript and for providing a copy of their upcoming revision of Palaearctic *Discomyza*.

### References

- Beaver, R. A. 1972. Ecological studies on Diptera breeding in dead snails. 1. Biology of the species found in *Cepaea nemoralis* (L.). *Entomologist* 105: 41-52.
- Bohart, G. E. and J. L. Gressitt 1951. Filth-inhabiting flies of Guam. *Bulletin of the Bernice P. Bishop Museum* 204: 152 pp.

- Buck, M. 1997. Untersuchungen zur ökologischen Einnischung saprophager Dipteren unter besonderer Berücksichtigung der Phoridae und Sphaeroceridae (Brachycera/Cyclorrhapha). Ph.D. thesis, University of Ulm, Germany, v + 194 + lv pp. Published: Cuvillier Verlag, Göttingen.
- Cresson, E. T. 1939. Description of a new genus and ten new species of Ephydriidae, with a discussion of the species of the genus *Discomyza* (Diptera). *Notulae Naturae*, Academy of Natural Sciences of Philadelphia 21: 1-12.
- Disney, R. H. L. 1970. A note on *Discomyza similis* Lamb and other flies reared from dead snails in Cameroon. *Entomologist's monthly magazine* 105: 250-251.
- Ferrar, P. 1987. A guide to the breeding habits and immature stages of Diptera Cyclorrhapha. *Entomonograph* 8; E. J. Brill, Leiden, 478 pp.
- Joswig, W. 1985. Untersuchungen zur Konkurrenz und Koexistenz necrophager Dipteren in toten Gehäuseschnecken. Ph.D. thesis, University of Bayreuth, Germany, ii + 122 + 9 pp.
- Judd, W. W. 1957. Insects reared and collected from the pond snail, *Lymnaea palustris* Müll., at London, Ontario. *Entomological News* 68: 69-72.
- Mathis, W. N. and T. Zatwarnicki. 2005. Revision of New World species of shore fly genus *Discomyza* Meigen (Diptera: Ephydriidae). *Annals of the Entomological Society of America* 98: 431-443.
- Wirth, W. W. 1971. *Platygymnopa* a new genus of Ephydriidae reared from decaying snails in North America (Diptera). *Canadian Entomologist* 103: 266-270.
- Wirth, W. W., W. N. Mathis, and J. R. Vockeroth. 1987. 98. Ephydriidae. pp. 1027-1047 *In* Manual of Nearctic Diptera, Vol. 2. McAlpine, J. F., Peterson, B. V., Shewell, G. E., Teskey, H. J., Vockeroth, J. R., and Wood, D. M. (eds.). Research Branch, Agriculture Canada, Monograph 28; Ottawa.
- Zatwarnicki, T. and W. N. Mathis, in press. A revision of the Palearctic species of the shore-fly genus *Discomyza* Meigen (Diptera: Ephydriidae). *Insect Systematics and Evolution*.



## THE PROBLEMATIC NEOTROPICAL GENUS *CYRTOPHORINA* BORGMEIER & PRADO (DIPTERA: PHORIDAE)

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### Abstract

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The Neotropical genus *Cyrtophorina* is revised, with redescription of the previously known species, *C. deinocerca* Borgmeier & Prado, and description of three new species: *C. kerri* and *C. zamorensis* from Ecuador and *C. gorgonensis* from Colombia. The hypothesized phylogenetic relationships among the species, as well as their possible relationship to *Dohrniphora* Dahl are discussed.

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### Introduction

Among the Neotropical phorid flies, *Cyrtophorina* Borgmeier & Prado (1975) is one of the most poorly known genera. Described from two specimens of the type species, *C. deinocerca* Borgmeier & Prado from Brazil and a third specimen later reported from Ecuador (Brown 1993a), there is virtually no other published information.

Based on the relatively dorsal position of the anterior thoracic spiracle, Borgmeier and Prado placed this genus in the subfamily Aenigmatiinae, a possibility supported by Brown (1993a). However, in his revision of the higher classification of phorids, Brown (1992) reorganized the Aenigmatiinae to include many taxa that were previously classified in the non-monophyletic subfamily Phorinae. One such reclassified genus was *Dohrniphora* Dahl, a group with which *Cyrtophorina* is herein suspected of having a close relationship.

In this study, I redescribe and more fully illustrate the type species of *Cyrtophorina*, based a number of newly collected specimens. I also describe three new species, and give evidence for the phylogenetic relationships of the genus.

### Dedication

This paper is dedicated to the memory of Dr. David Pengelly, who was the professor for my first university entomology course. Because of his encouragement and inspirational teaching, as well as the acceptance and camaraderie displayed by his group of exceptionally talented graduate students, I decided to pursue entomology as a profession, rather than just as a hobby.

## Materials and Methods

Specimens were collected by Malaise traps, dried chemically using HMDS (Brown 1993b), and glued to the side of insect pins. Besides the usual locality label, each specimen also has a barcoded data label with a unique identifier. These identifiers are given for holotypes, for easier recognition in the future.

Specimens examined are from the Natural History Museum of Los Angeles County (LACM), Museu Paraense Emilio Goeldi, Belém, Brazil (MPEG), and the Universidad Nacional de Colombia, Bogotá (UNCB).

Specimen images are archived at MorphBank. Maps of species distributions are available at [www.discoverlife.org](http://www.discoverlife.org).

## Systematics

### Genus *Cyrtophorina* Borgmeier & Prado, 1975

*Cyrtophorina* Borgmeier & Prado, 1975: 85.

**Type species:** *Cyrtophorina deinocerca* Borgmeier & Prado, by original designation.

**Emended diagnosis.** Median furrow of frons absent. Mouthparts, other than palpus, vestigial, probably nonfunctional, except in *C. gorgonensis*. Thoracic spiracle displaced dorsally (less so in *C. gorgonensis*); anepisternum undivided, with few setae ventral to spiracle. Foretibia with dorsal row of small, spinelike setae. Posterior face of hind femur with ventrobasal patch of hairlike setae of two sizes (small and large). Hind tibia with one dorsal longitudinal setal palisade. Wing fully developed, with costal setae extremely short. Wing vein  $R_1$  thickened on apical one-half; vein  $R_{2+3}$  present. Male genitalia with epandrium and hypandrium fused anteriorly. Hypandrium extremely deeply cleft, with two lobes only joined at anterior extremity of terminalia (as in *Dohnniphora*).

**Phylogenetic relationships.** Borgmeier and Prado (1975) diagnosed this genus from two male specimens of the single species *C. deinocerca*, and placed it in the subfamily Aenigmatiinae based on the dorsally-opening anterior thoracic spiracles. They compared it to the genus *Aenigmatopoeus* Schmitz, a genus now classified in the subfamily Metopiniinae (Disney 2003) and which has little relationship to *C. deinocerca*. In his reanalysis of the subfamilies, Brown (1992) did not place this genus, but noted in another paper (Brown 1993a) that it could be classified with other Aenigmatiinae, unlike some other genera included there.

Upon examination of the specimens herein, there is evidence for a close relationship with *Dohnniphora* Dahl, which is part of Brown's (1992) expanded concept of Aenigmatiinae, a concept that is not equivalent to that of Borgmeier and Prado (1975) or Brown (1993a). Characters that link the three *Cyrtophorina* species with *Dohnniphora* are the dorsally setose anepisternum, a row of enlarged setae on the foretibia, a single dorsal setal palisade on the mid and hind tibia (midtibial palisade absent in some species), and a ventrobasal

patch of setae on hind femur. Furthermore, *C. gorgonensis*, a new species, is apparently a transitional form, as it has *Dohnniphora*-like frontal setae and wing venation. This genus, as well as some others in the Old World tropics (such as *Synaptophora* Brown, *Dicranopteron* Schmitz, *Myopiomyia* Disney) are possibly just highly derived *Dohnniphora* and their recognition could lead to paraphyly of *Dohnniphora* itself. Unfortunately, female specimens of *Cyrtophorina*, which would likely add important new characters for consideration, are still unknown. Further molecular phylogenetic research into the monophyly of *Dohnniphora*, and other questions involving the phylogenetic relationships of non-metopinine phorids, is currently being pursued (B. Brown and P. Smith, in preparation).

The monophyly of the Aenigmatiinae, as defined by Brown (1992) was challenged by Disney (1993) and Disney and Ellwood (2001). They considered Brown's two aenigmatiine subdivisions, Aenigmatiini and Diplonevrini, to be less closely related than did Brown (1992). I agree with some of their criticism, especially that *Synaptophora* is related to *Dohnniphora*, possibly just a highly derived species of this genus, and should not have been placed in the Aenigmatiini, but instead belongs in the Diplonevrini. The monophyly of the Aenigmatiini (as conceived by Brown, 1992) is not well supported, given the repeated evolution of the limuloid body form (e. g. Brown 1993a). The higher taxa of non-metopinine phorids, however, are currently being revised based on molecular characters (as noted above), and it is likely that our ideas about the relationships of many of these higher groups will be changed.

Monophyly of *Cyrtophorina* itself is also questionable. A possible synapomorphic character for the genus is the reduced costal setae, but strong evidence is still lacking. In spite of this uncertainty, I place the new species in *Cyrtophorina* until a better understanding of their relationships can be developed.

Disney and Ellwood (2001) described a new genus, *Dohnnigma*, that has some similarity to *Cyrtophorina*, as it lacks frontal setae, has reduced costal setae, and is probably closely related to *Dohnniphora*. It differs from *Cyrtophorina* by the larger, thicker, more *Dohnniphora*-like setae on the inner face of the hind femur, the lack of wing vein  $R_{2+3}$ , and by the shape of the terminalia. Probably a number of currently recognized genera would render *Dohnniphora* paraphyletic if the phylogeny of the group were known; for now it is premature to include *Dohnnigma* within *Cyrtophorina*.

Within the genus *Cyrtophorina*, some preliminary relationships can be hypothesized, based on the following derived character states (see cladogram Fig. 1) polarized with *Dohnniphora* as an outgroup: 1—costal setae reduced (primitive state: costal setae longer); 2—spiracle more dorsal in position (primitive state: spiracle more lateral); 3—mouthparts reduced, probably nonfunctional (primitive state: mouthparts well-developed, functional); 4—midtibia without basal pair of setae (primitive state: basal pair of setae present); 5—wing vein Rs without seta at base (primitive state: seta present); 6—fork of Rs reduced in size (primitive state: fork large, elongate); 7—hind femur thin (primitive state: hind femur broad); 8—ocellar triangle with medial depression (primitive state: ocellar region flat); 9—frontal setation reduced (primitive state: frons with ventral interfrontal, ventral fronto-orbital, and supra-antennal setae present); 10—scutellum with 8 or more setae (primitive state: scutellum with 4 setae).

These traits were analyzed manually, using *Dohnniphora* as an outgroup, and a cladogram (Fig. 1) was produced. A close relationship between *M. deinocerca* and *M.*

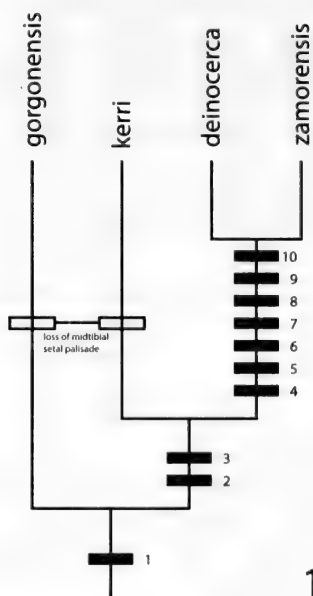


FIGURE 1. Cladogram of hypothesized relationships of genus *Cyrtophorina*.

*zamorensis* is strongly supported, while there is less evidence for the group *C. kerri* + (*C. deinocerca* + *C. zamorensis*). An apparent homoplasy is the loss of the midtibial setal palisade in *C. gorgonensis* and *C. kerri* new species.

***Cyrtophorina deinocerca* Borgmeier & Prado, 1975**

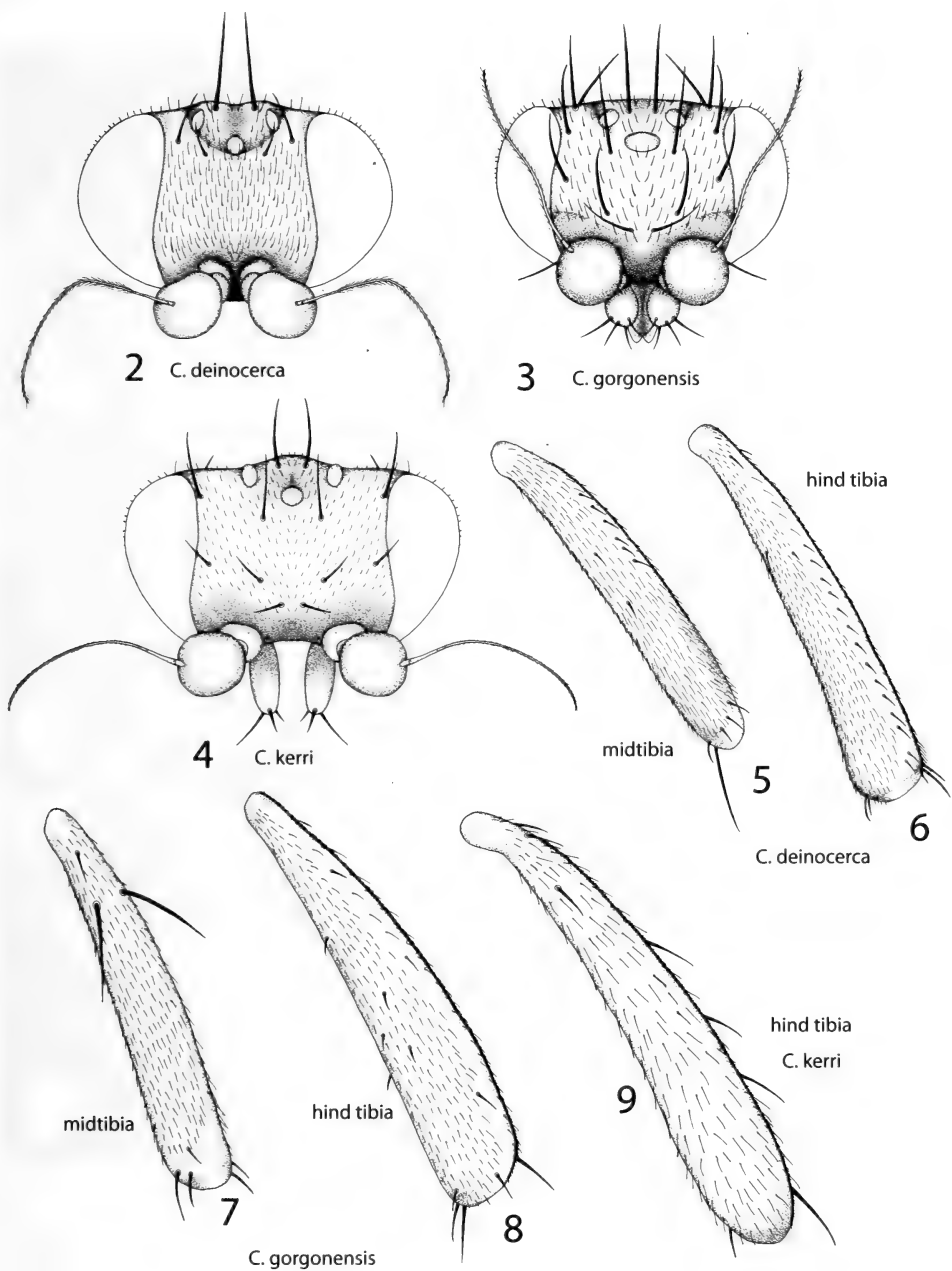
(Figs. 2, 5, 6, 10, 11, 18, 19, 20, 30)

*Cyrtophorina deinocerca* Borgmeier & Prado, 1975: 85, 86, figs. 152, 153, 154.

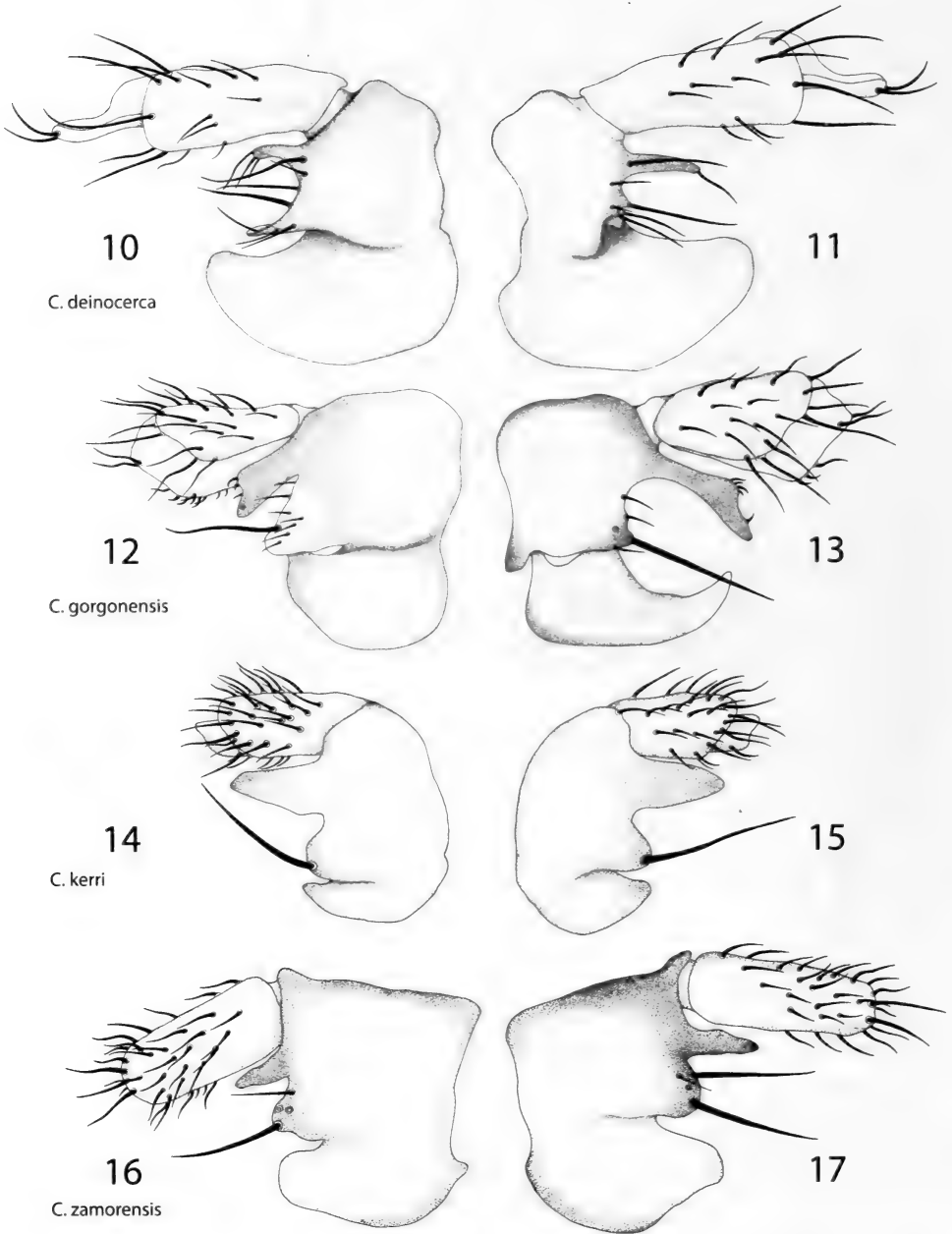
**Holotype.** ♂, **BRAZIL, Rondônia:** Vilhena, November 1973, Roppa and Alvarenga, Malaise trap, MZSP, not examined.

**Diagnosis.** This species can be easily recognized by the reduced frontal setation and the structure of the male terminalia, as illustrated in the original description. It can be keyed to the proper genus in Disney's (1994) latest key to phorid genera.

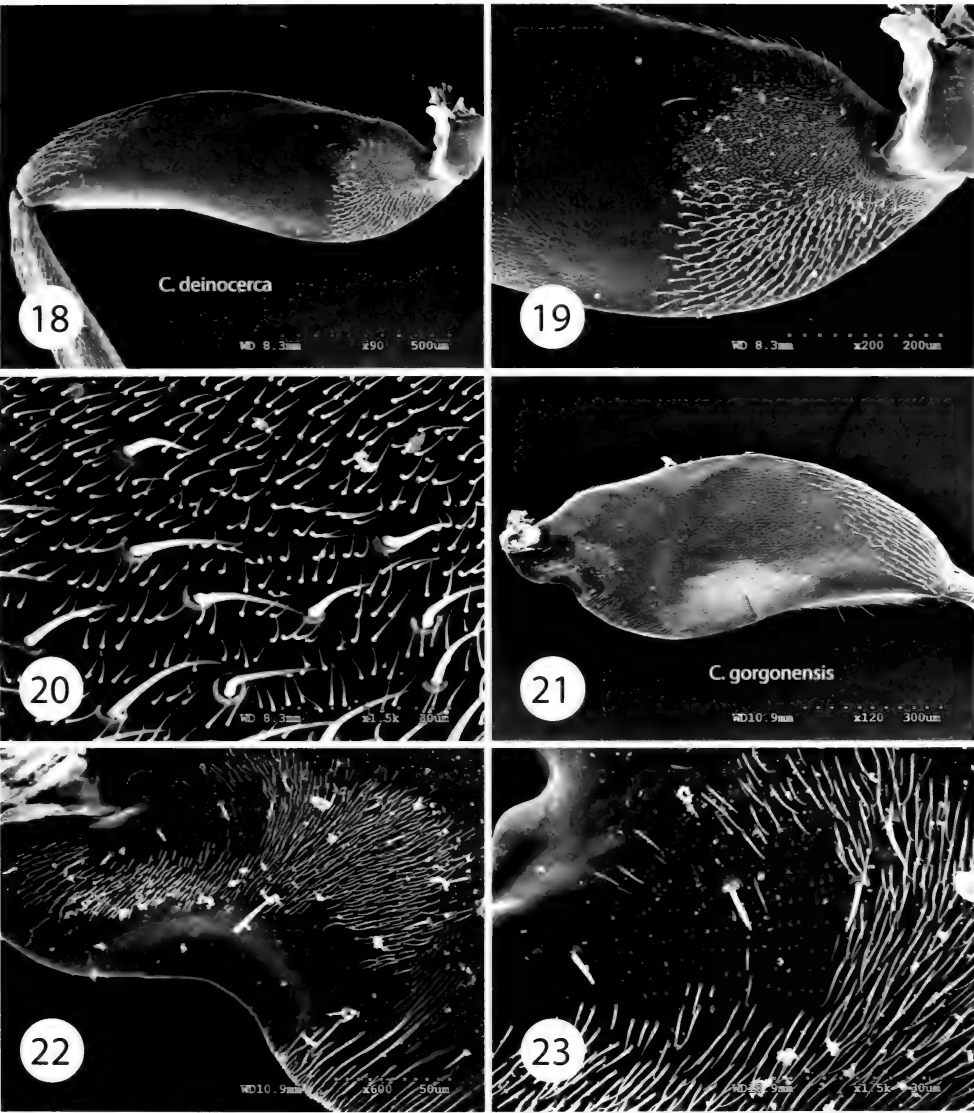
**Description. Male.** Body length 2.38-2.88 mm. Frons dark brown, broad, with dense, long, fine setulae. Frontal setae represented by dorsal interfrontal, postocellar, and one other pair, possibly dorsal fronto-orbital setae (Fig. 2); ventral fronto-orbital, ventral interfrontal, inner vertical, and supra-antennal setae apparently absent. Ocellar region



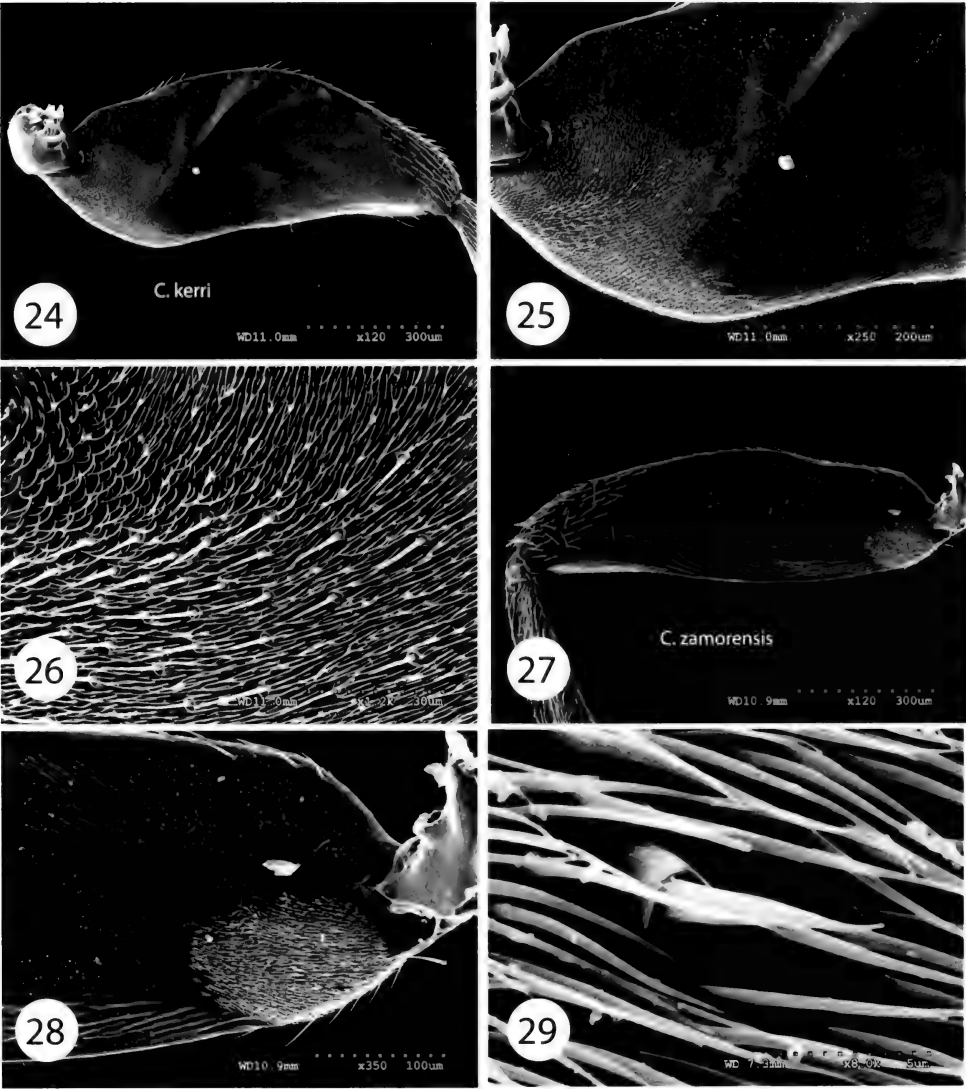
FIGURES 2-9. Heads and tibiae of *Cyrtophorina* spp., anterior view.



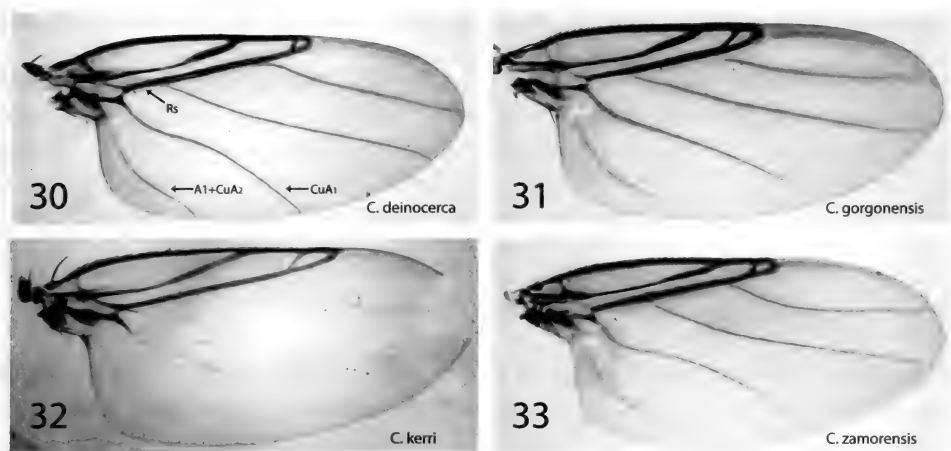
FIGURES 10-17. Terminalia, right side, left side, of *Cyrtophorina* spp..



FIGURES 18-23. Posterior face of hind femur, increasing magnification. 18-20: *C. deinocerca*; 21-23: *C. gorgonensis*.



FIGURES 24-29. Posterior face of hind femur, increasing magnification. 24-26: *C. kerri*; 27-29. *C. zamorensis*.

FIGURES 30-33. Wings of *Cyrtophorina* spp..

raised, concave centrally. Gena with few strong setae. Flagellomere 1 light brown, globose; arista dorsoapical, with relatively long microtrichia. Palpus brown, small, with one medium sized seta and several smaller ventral setae; other mouthparts reduced to two short, yellow, setose lobes. Scutum dark brown, broad; pleuron dark brown anterodorsally (proepisternum, dorsum of anepisternum), yellowish-brown posteriorly. Scutellum with 5-9 setae on each side, four of which (including most medial seta) are largest, others about one-half size. Anterior thoracic spiracle clearly dorsal in position, with several setulae lateral and ventral to it on anepisternum. Legs yellowish-brown. Foretibia with anterior row of about 13 short, enlarged, spinelike setae. Mid and hind tibiae (Figs. 5, 6) with variety of short, spine-like anteroventral to anterodorsal setae; dorsal setal palisade present on basal two-thirds of midtibia and entire length of hind tibia. Hind femur narrow (Fig. 18), with large patch of large and smaller ventrobasal setulae on posterior face (Figs. 19, 20). Mean costal length 0.64 wing length, range 0.62-0.67. Radial veins brown; base of vein Rs without seta; fork of Rs relatively small (Fig. 30). Veins  $CuA_1$  and  $A_1+CuA_2$  complete, extending to margin of wing;  $A_1+CuA_2$  recurved posteriorly at apex. Three alular setae present. Halter light brown. Abdominal tergites dark grayish-brown, venter of abdomen gray. Terminalia yellowish brown, contrasting strongly with rest of dark-colored abdomen. Right side of epandrium (Fig. 10) with long, dorsal, pointed process and extremely short ventral process; posterior margin with several long setae. Left side of epandrium similar (Fig. 11), except ventral process longer and both processes bearing setae. Cercus elongate, deep; hypoproct dorsoventrally flat, arising within cercus at mid-depth. **Female.** Unknown.

**Geographical distribution.** Amazonian South America. In addition to the records below, the original specimens were collected in Rondônia, Brazil, and Brown (1993a) reported a specimen from Pastaza, Ecuador.

**New material examined.** **BRAZIL, Pará:** Benevides, Fazenda Morelandia, ♂, 30 June–2 July 1988, F. F. Ramos, suspended [Malaise] trap, 1.6 m, MPEG, Serra Norte, ♂, 25–28 October 1985, W. França, suspended [Malaise] trap, 1.6 m, MPEG. **COLOMBIA, Amazonas:** Amacayacu NP, S 3.82°, W 70.26°, ♂, 1988, M. Kelsey, Malaise trap, varzea forest, UNCB, 2♂, 27 August–2 September 1997, 2♂, 3–5 September 1997, M. Sharkey, Malaise trap, LACM. **ECUADOR, Napo:** Yasuní Biological Research Station, S 0°67', W 76.39°, ♂, 18–22 May 1996, B. Brown, 220 m, Malaise trap #2, primary forest, LACM.

*Cyrtophorina gorgonensis* n. sp. (Figs. 3, 7, 8, 12, 13, 21, 22, 23, 31)

**Holotype.** ♂, **COLOMBIA, Cauca:** Isla Gorgona, N 2.97°, W 78.18°, 29 February–4 March 2000, B. Brown, G. Kung, M. Sharkey, Malaise trap #3, barcode: LACM ENT 152620, UNCB.

**Paratype.** ♂, **COLOMBIA, Valle de Cauca:** PNN Farallones de Cali, Anchicaya, N 3.43°, W 76.80°, 8 May–19 June 2001, S. Sarria, Malaise trap, 900 m, CAP–1894, LACM.

**Diagnosis.** This species can be recognized by the complete frontal setation, setation of the tibiae, and shape of the male terminalia.

In Disney's (1994) key to phorid genera, this species more or less keys to *Dohrniphora* (couplet 51), by virtue of it having a few setulae near the dorsal margin of the anepisternum, but differs in other characters given. It also does not match the alternatives for the other two genera keyed at couplet 52 (*Diplonevra* Lioy and *Psyllomyia* Loew).

**Description. Male.** Body length 2.06 mm. Frons brown, broad, with small setulae (Fig. 3); all major frontal setae present (ventral and dorsal interfrontal and fronto-orbital setae, inner vertical seta, postocellar seta) plus one pair of divergent, dorsally directed supra-antennal setae; all frontal setae of normal size. Ocellar region flat. Gena with few well developed setae. Flagellomere 1 lighter brown, globose, arista dorsoapical, with relatively long trichia. Palpus brown, normal sized, with large apical and smaller ventral setae. Labella well developed, presumably functional. Thorax dark brown, broad dorsally. Scutellum with total of 4 subequal setae. Anterior thoracic spiracle slightly displaced dorsally relative to *Dohrniphora* species, with two setulae posterior and ventral to it on anepisternum. Legs light brown. Foretibia with anterior row of 13 thickened, spinelike setae. Midtibia with basal pair of setae, plus one smaller anterior seta near apex (Fig. 7); lacking dorsal setal palisade. Hind femur relatively broad (Fig. 21), with small concavity near base, and small, round patch of mostly smaller (but also some larger) setulae (Figs. 22, 23). Hind tibia with scattered enlarged setae; with one dorsal setal palisade (Fig. 8). Costa 0.60 wing length. Radial veins dark brown; Rs with small seta at base (not visible in Fig. 31); fork of Rs relatively large, narrow, *Dohrniphora*-like (Fig. 31). Veins  $CuA_1$  and  $A_1+CuA_2$  incomplete, not extending to margin of wing;  $A_1+CuA_2$  not recurved posteriorly at apex. One alular seta present. Halter brown. Abdominal tergites brown, venter of abdomen gray. Male terminalia dark brown; hypandrium joined narrowly to epandrium anteriorly. Posterior margin of right side of epandrium (Fig. 12) with dorsal elongate process and ventral long seta; left side similar (Fig. 13). Cercus and hypoproct deep. **Female.** Unknown.

**Geographical distribution.** Colombia.

**Derivation of specific epithet.** Named for Isla Gorgona, where the holotype specimen was collected.

*Cyrtophorina kerri* n. sp. (Figs. 4, 9, 14, 15, 24, 25, 26, 32)

**Holotype.** ♂, **ECUADOR, Sucumbíos:** Sacha Lodge, S 0.5°, W 76.5°, 1-31 December 1994, P. Hibbs, Malaise trap, 270 m, barcode: LACM ENT 050767, LACM.

**Diagnosis.** This species can be recognized by the reduced size of the frontal setae and the extremely unusual male terminalia (with an exceptionally long seta). The wing also has a number of peculiarities, such as the long basal seta at the base of Rs and the greatly reduced size of the microtrichia on the wing blade.

In Disney's (1994) key to genera, this species keys in a similar manner to *C. gorgonensis* at couplet 51.

**Description. Male.** Body length 2.25 mm. Frons brown, broad, finely setose, with 4-4-2 frontal setae (lower and upper fronto-orbital and interfrontal setae, plus postocellar setae; inner vertical seta absent) plus one pair dorsally-curved supra-antennal setae (Fig. 4). Ocellar region flat. Gena with few, fine setae. Flagellomere 1 light brown, globose; arista dorsoapical, with extremely short fine pubescence. Palpus orange-brown, well developed, with 2-3 long apical setae and several much shorter, ventral setae; other mouthparts virtually absent. Scutum grayish-brown, broad; pleuron dark brown anterodorsally (proepisternum, dorsum of anepisternum), yellowish-brown posteriorly. Scutellum with short anterior seta (about twice length of short setulae on scutum) and much longer, thicker posterior seta (about 2.5 times length of anterior seta). Anterior thoracic spiracle clearly dorsal, and with many setulae extending lateral and ventral of it to dorsal margin of pleuron. Legs yellowish-brown, except midcoxa dark brown. Foretibia with anterodorsal row of 8 slightly enlarged, spinelike setae on apical two-thirds. Midtibia with anterior and dorsal setal pair near base, plus one subapical anterior seta and two slightly differentiated posterodorsal setae near apical two-thirds; setal palisade absent. Hind femur broad (Fig. 24), with large patch of large and smaller setulae on posterior face (Figs. 25, 26). Hind tibia with one anterior seta near base and three enlarged posterodorsal setae along length; setal palisade present (Fig. 9). Costa 0.68 wing length (Fig. 32). Microtrichia on wing blade extremely small. Radial veins yellowish-brown; base of vein Rs with one long (0.15 mm) seta; fork of Rs relatively broad. Posterior veins faint. Veins  $CuA_1$  and  $A_1+CuA_2$  incomplete, not extending to margin of wing;  $A_1+CuA_2$  not recurved posteriorly at apex. One alular seta present. Halter brown. Abdominal tergites brown, venter of abdomen gray. Male terminalia brown, cercus lighter. Right side of epandrium with large dorsal pointed posterior process and shorter more rounded ventral process, the latter bearing extremely long seta (Fig. 14); left side similar (Fig. 15). Cercus deep, hypoproct normal. **Female.** Unknown.

**Geographical distribution.** Ecuador.

**Derivation of specific epithet.** Named for Peter Kerr (formerly Peter Hibbs) who collected two of the new species described herein.

*Cyrtophorina zamorensis* n. sp. (Figs. 16, 17, 27, 28, 29, 33)

**Holotype.** ♂, ECUADOR, Zamora Chinchipe: Río Bombuscaro, S 4.12°, W 78.98°, 26 June–4 July 1996, P. Hibbs, Malaise trap, 1050 m, barcode: LACM ENT 134786, LACM.

**Diagnosis.** This species closely resembles *C. deinocerca*, but the male terminalia differ markedly (especially evident on the right side, contrast Figs. 10, 16), and the mid and hind tibiae lack any enlarged, isolated setae.

In Disney's (1994) key, this species keys at couplet 96 to *Egregiophora* Beyer, a genus that is much larger in body size, has well developed frontal setae, and belongs in another subfamily.

**Description. Male.** Body length 1.90 mm. Frons brown, broad, setose, bare of large setae except inner vertical seta and postocellar seta. Ocellar region concave. Gena with few medium sized setae. Flagellomere 1 lighter brown, oval, slightly flattened; arista dorsoapical, with relatively long trichia. Palpus dark brown, small, with medium sized setae. Other mouthparts greatly reduced, probably nonfunctional. Scutum brown, broad dorsally. Scutellum with 8 setae. Dorsum of anepisternum brown, rest of pleuron yellowish. Anterior thoracic spiracle clearly dorsal, and with many setulae extending lateral and ventral of it to dorsal margin of pleuron. Forelegs missing in sole specimen. Mid and hind legs yellowish brown. Hind femur narrow (Fig. 27), with small posteroventral, round patch of mostly smaller (but also some larger) setulae (Figs. 28, 29). Mid and hind tibiae with dorsal setal palisade, but lacking large isolated setae. Costa 0.58 wing length. Radial veins dark brown; Rs without seta at base; fork of Rs relatively small. Veins  $CuA_1$  and  $A_1+CuA_2$  incomplete, not extending to margin of wing;  $A_1+CuA_2$  not recurved posteriorly at apex. One alular seta present. Halter brown. Abdominal tergites brown, venter of abdomen gray. Male terminalia dark brown dorsally, lighter ventrally, cercus yellow. Right side of epandrium with two large setae and narrow posterior process dorsally (Fig. 16). Left side of epandrium with two large and one smaller setae, as well as narrow posterior process dorsally (Fig. 17). Cercus deep, hypoproct normal. **Female.** Unknown.

**Geographical distribution.** Ecuador.

**Derivation of specific epithet.** Named for the Ecuadorian province in which the specimen was collected.

## Key to Males of *Cyrtophorina* species

1. Midtibia with strong basal pair of setae, one near-dorsal, one anterior (Fig. 7); midtibia lacking dorsal setal palisade; frons with usual pairs of setae in three rows (Figs. 3, 4) .....2
- Midtibia lacking strong basal pair of setae, at most with scattered smaller setae (Fig. 5); midtibia with dorsal setal palisade present at least along most of length; frons lacking some or nearly all setae (Fig. 2) .....3
2. Hind tibia with three anterodorsal setae and several scattered anterior to ventral setae, lacking posterodorsal setae (Fig. 8); frontal setae stronger (Fig. 3) .....*Cyrtophorina gorgonensis* n. sp.
- Hind tibia with only a single anterior seta near base, but with three large posterodorsal setae (Fig. 9); frontal setae reduced in size, delicate (Fig. 4) .....*Cyrtophorina kerri* n. sp.
3. Midtibia with few scattered enlarged dorsal to ventral setae (Fig. 5); right side of epandrium with two long, thin processes (Fig. 10); frons with dorsal interfrontal setae present near anterior ocellus (Fig. 2) .....*Cyrtophorina deinocerca* Borgmeier & Prado
- Midtibia without isolated setae; right side of epandrium with ventral process broad, short (Fig. 16); frons lacking dorsal interfrontal setae .....*Cyrtophorina zamorensis* n. sp.

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## References

- Borgmeier, T. and A. P. do Prado. 1975. New or little-known Neotropical phorid flies, with description of eight new genera (Diptera, Phoridae). *Studia Entomologica* 18: 3-90.
- Brown, B. V. 1992. Generic revision of Phoridae of the Nearctic Region and phylogenetic classification of Phoridae, Sciadoceridae and Itonomyiidae (Diptera: Phoridae). *Memoirs of the Entomological Society of Canada* 164: 1-144.

- Brown, B. V. 1993a. Convergent adaptations in some Phoridae (Diptera) living in the nests of social insects: a review of the New World Aenigmatiinae, *In* Systematics and entomology: diversity, distribution, adaptation and application. Ball, G. E. and Danks, H. V. (eds.), *Memoirs of the Entomological Society of Canada* 165: 115-137.
- Brown, B. V. 1993b. A further chemical alternative to critical-point-drying for preparing small (or large) flies. *Fly Times* 11: 10.
- Disney, R. H. L. 1993. Notes on European Phoridae (Diptera). *British Journal of Entomology and Natural History* 6: 107-118.
- Disney, R. H. L. 1994. Scuttle flies—the Phoridae. Chapman & Hall, London. xii + 467 pp.
- Disney, R. H. L. 2003. The dorsal abdominal glands and the higher classification of the Phoridae (Diptera). *Zootaxa* 293: 1-16.
- Disney, R. H. L. and M. D. F. Ellwood. 2001. An intriguing new genus of scuttle fly (Diptera: Phoridae) from Borneo. *Fragmenta Faunistica* 44: 319-328.





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